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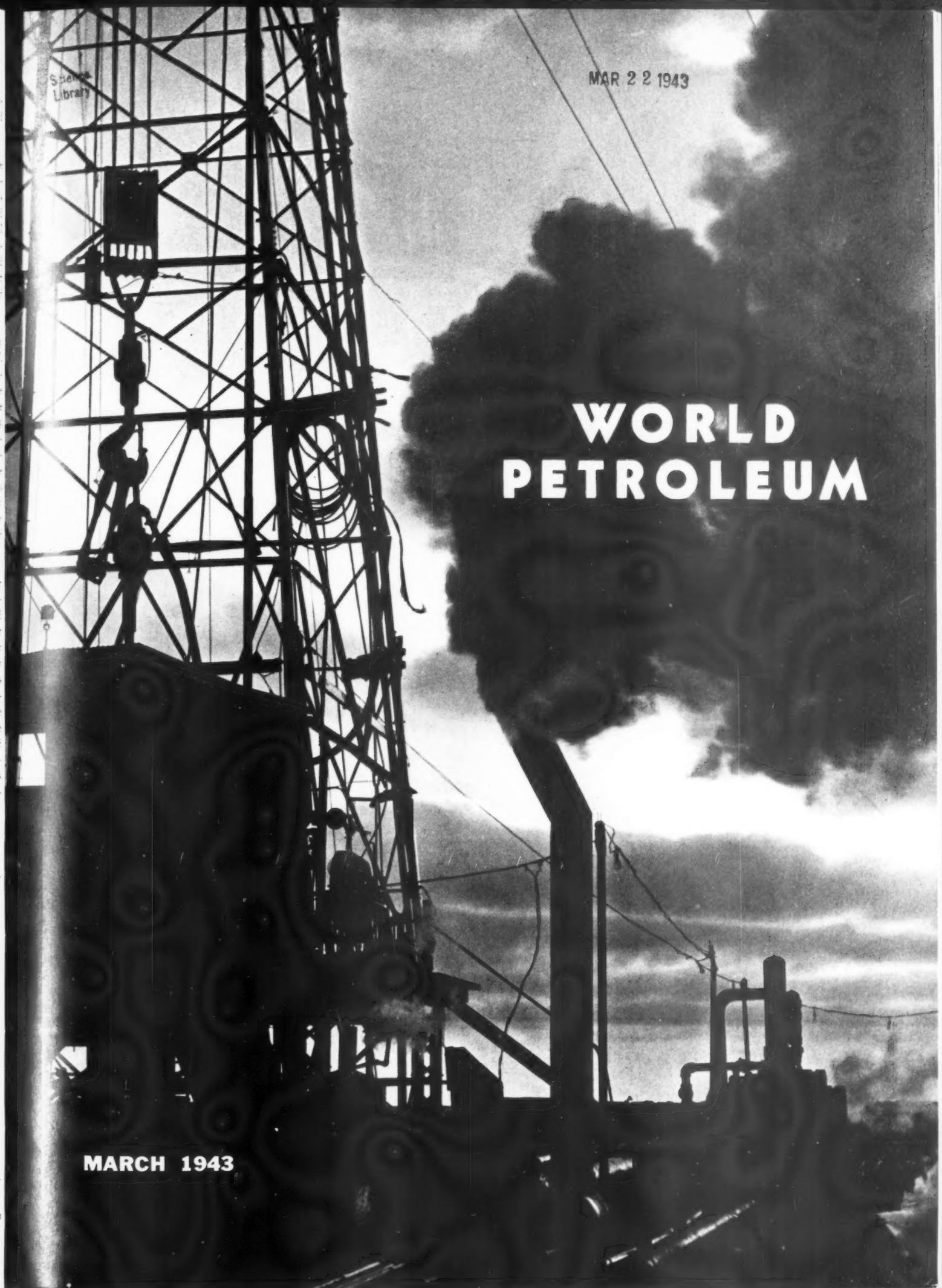
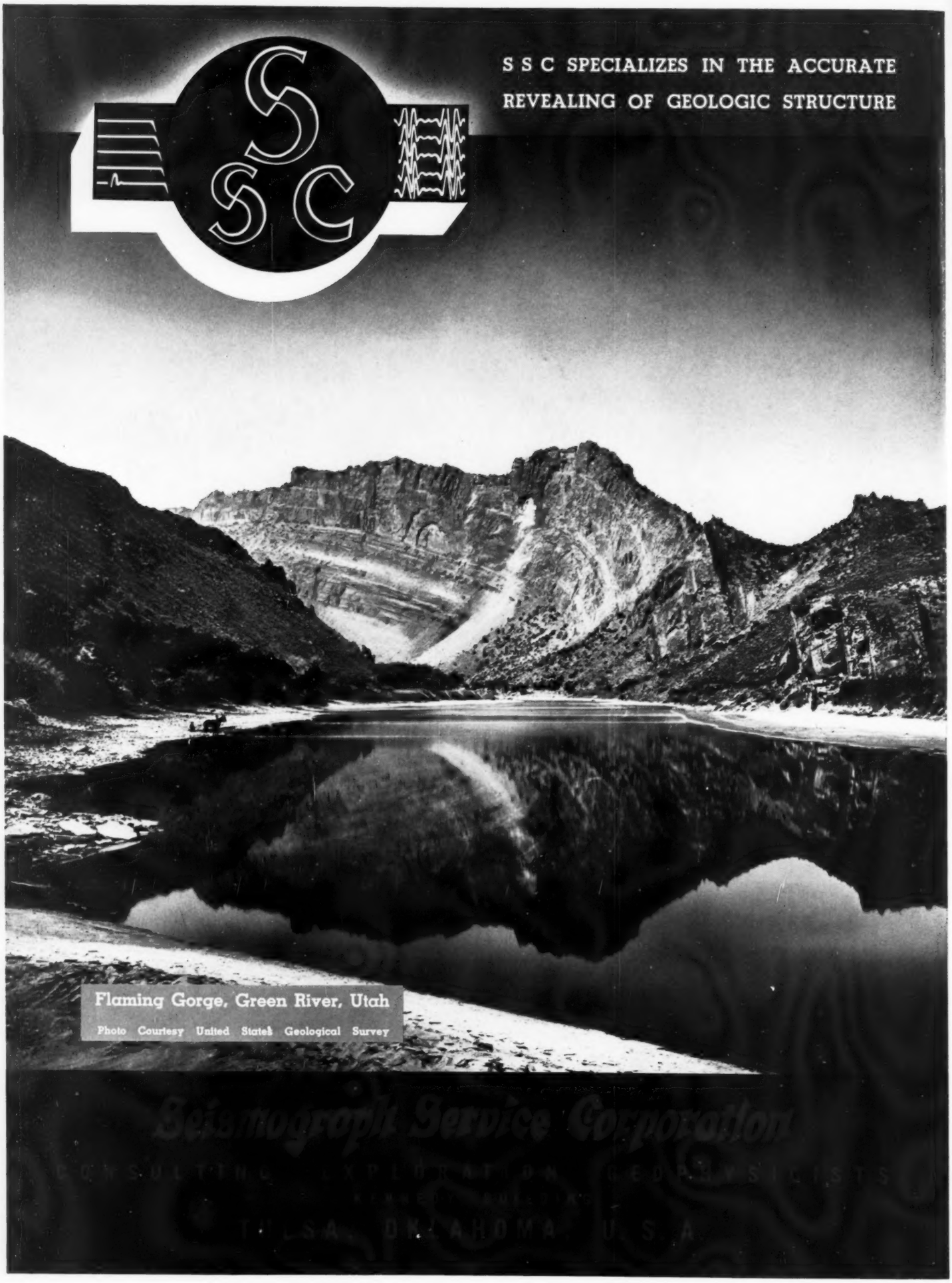


WORLD PETROLEUM

MARCH 1943


S S C SPECIALIZES IN THE ACCURATE
REVEALING OF GEOLOGIC STRUCTURE
Flaming Gorge, Green River, Utah
Photo Courtesy United States Geological Survey
Seismograph Service Corporation

WORLD PETROLEUM

Incorporating Petroleum Equipment Exporter

THE MANAGEMENT PUBLICATION OF THE INTERNATIONAL PETROLEUM INDUSTRY

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EDITORIAL

PETROLEUM PRICE A PROBLEM OF NATIONAL CONCERN

WAR imposes many hardships. It inflicts many casualties. In the industrial field the most numerous victims are small businesses. Their financial weakness cannot withstand the pressures and the burdens put upon them. As materials become increasingly scarce, as available manpower diminishes, as the pressure for efficiency in production becomes greater with the narrowing margin between costs and income the weaker fall by the wayside. Nothing contributes more directly to this result than fixed prices for products with uncontrolled costs of labor and materials entering into their production.

This explains to a degree the fact that the most strenuous opposition to ceiling prices comes from small business men. They feel the pinch first and most severely. It explains the plight of the smaller oil producers of the country which is so strikingly set forth on other pages of this issue. They face the more immediate danger of being forced out of business through insistence by the federal price authority on retaining an arbitrary and uneconomic price ceiling upon their product. Yet this is not the most compelling argument for price revision. Many other small proprietors in other lines of activity are being eliminated in the economic upheaval and destruction spread by war. If they have to be sacrificed in order to insure success in the fight of freedom that sacrifice is regrettable but inevitable.

The fundamental reason why the necessity for oil price readjustment is being reiterated in face of opposition by the official agency exercising price control is the country's imperative need for more oil—oil to fight its own battle and to sustain the efforts of its allies. It so happens that in this instance the needs of the nation and the interests of the oil producers, more particularly the smaller producers, are identical and inseparable.

No longer can the query be raised, "Do we need more oil?" The need is upon us and becomes more pressing every hour. The question is "How are we to win the oil that will win the war and hold the peace?" The answer is not difficult. It is to extend to oil the same treatment that has been applied to other industries in which the need of the hour called for expanded production. To get a vastly increased output of planes, tanks, ships and munitions the government lent its active support in facilitating expansion and obtaining needed materials. Above all it provided a margin between costs and price sufficient to cover expansion and development and to leave a moderate profit after payment of taxes. Can anyone assert that oil is less a war essential than any of these things? On the contrary, as so tellingly expressed by Judge Cole, "the number and operation of practically all our military equipment is limited by the petroleum products that can be delivered to the point of use."

Earlier discussion of the petroleum price problem centered largely upon the urgency of finding new reserves, but the problem is not limited to that. It is true that in the past few years the growth of reserves has slackened, the volume of oil discovered per wildcat well drilled has declined, the size of new fields has decreased, the proportion of dry holes has risen and the cost of exploratory drilling, per well and per foot, has advanced. All this indicates the necessity of more intensive survey and much more drilling in order to maintain reserves at a safe level in relation to the expanding demand for petroleum products. It calls for a policy which will make such activities possible.

From the viewpoint of national safety and welfare however other considerations must be taken into account. We must not merely add to our reserves but we must conserve and bring into use the known unproduced oil beneath established fields. We must keep in operation as many as possible of the wells of small production which are being abandoned by the thousand because they cannot repay the cost of operation under present prices, and we must make it possible to introduce methods of secondary recovery of the oil otherwise unobtainable which will be irretrievably lost by such abandonments. These small stripper wells in the United States have a combined yearly output greater than the total of any other oil producing nation. That surely is a national asset worthy of preservation.

A time of emergency is not a time to experiment with new and uncertain ways of serving national needs. Past experience has shown that the effective means of expanding oil supplies is to provide a price for oil that will at least provide a fair chance of covering the cost of survey, drilling and other recognized means of increasing production. A suitable rise in the selling price of crude oil will serve this pressing need in several ways. It will encourage the search for new fields, open the way for the extension of secondary recovery projects and postpone the abandonment of stripper wells. No other plan proposed will accomplish all these ends or assure success in attaining any one of them.

Left: A good crew must have perfect timing and cooperation to handle the heavy tools at the high speeds of modern oil well drilling.

Making a shot. Photo by Robert Yarnall Richie.

WAR DEMANDS MORE OIL—
More Exploration

By E. L. DeGolyer

E. L. DeGolyer, Assistant Deputy Petroleum Administrator For War.

THE COMING OF WAR has wrought sharp and sudden changes in the pattern of the oil industry. The most obvious and most striking of such changes have been in the fields of transportation and refining.

A third of the world's total oil production formerly started to market, tanker-borne, over the waters of the Gulf and Caribbean. Most of this oil went to our North Atlantic ports, supply points for the world's greatest consuming centre. This tremendous traffic, disrupted by the loss of tankers as a result of destruction by the activity of enemy submarines, has had to be substituted largely by such lines of supply as could be improvised without loss of too much time. There was no single solution for this gigantic problem nor is it likely to be entirely solved for some time to come. It has been solved in part, however, by re-arrangement, reversals, and patching up of existing pipe line systems; by overland transport of crude and products in tank cars on a scale never before attempted; by barging over inland waterways; and through the construction at long last of the "big-inch" line, the first leg of which is just being put into operation as far as Norris City, Illinois. The tank car traffic alone, reaching a peak of deliveries of 856,710 barrels per day into District I during the week ending September 19, 1942, and accomplished at an expense of millions of dollars in extraordinary transportation costs, defrayed by Defense Supply Corporation, and by the mobilization of tank cars from all over the nation, is a story worth the telling but by some of those who directed it and at the cost of more time than is available at the present.

Rapidly mounting needs for the fighting grades of gasoline—the 100-octane and 91-octane gasolines—for toluene, for the butadiene constituent of synthetic rubber, for greatly improved aviation and Diesel lubricants, and for numerous specialty products—chemicals to cutting oils—have revolutionized the refining industry and embarked us upon a construction program running into hundreds of millions of dollars and intended to supplement our already great refining industry. Products which only a few years ago were almost laboratory curiosities today must be produced in volume. The industry has changed from one in

Presented before Petroleum Economics Section, American Institute of Mining and Metallurgical Engineers, February 1943.

which ordinary motor fuels were the products in prime demand to one in which motor fuels are of secondary importance and the high octane products in prime demand to one in which motor fuels are of secondary importance and the high octane products and fuel oils are of first importance. The industry bids fair to develop into one of the most important of the chemical industries. As Joseph Stalin was recently quoted by the head of the British Oil Mission to the United States, "This is a war of engines and octanes."

The problems of the producing branch of the industry—those of exploring for new fields and exploiting existing fields—have been relatively unimportant up to the present time. Actually, the only operating problem which has been of serious concern has been that of rationing our sorely shrunken and continuously shrinking stock of oil well supplies. Indeed, in the early days of our preparation for war, we hardly recognized the existence of a problem of production. The nation was assured by various leaders of industry that the industry could meet any probable requirement that war was likely to thrust upon it. "By the mere opening of valves we could overnight add thirty percent to our production" is a fair example of the more restrained and considered type of statement to which I refer and it continued with the implication that this would take care of any extraordinary requirements due to war in addition to providing for ordinary public needs for a period of two years. There can be no question but what these statements were made honestly and in good faith. On behalf of those who made them it might even be said that there were certain assumptions implicit in the statements. The leaders of the industry could remember the last war. Drilling equipment, notably casing, became scarce at times and was hard to get but drilling was never restricted. There was no price control nor was there any critical shortage of manpower. Military operations, with but few unimportant exceptions, required the products which the industry was accustomed to manufacture. Rationing in civilian consumption was so little of a problem that it was solved voluntarily by the seven gasolineless Sundays and a few heatless days.

It is true that as we went into the present crisis, the industry was not reliably informed with regard to its ability to produce and that it had overrated somewhat its productive capacity. At the end of ten years of producing under pro-ration, estimated potentials had been built up in some areas to fantastic and unreal figures. California and Kansas are fair examples of such practice.

The industry, therefore, did not understand the magnitude of the demands which it was to face nor the severity of the restrictions under which it would have to operate and it also overrated its capacity to produce. The net result of its overly optimistic statements made eighteen months to two years ago when the inevitability of our entrance into the war became increasingly apparent, was to carry an unwarranted conviction to administrators who do not have to follow the varying fortunes of the oil industry. Some such administrators to this very day are prone to deny to the industry supplies and assistance which are essential in the mistaken belief that the "crack the valve" idea is correct. This mistaken conviction has led even to suggestions that the industry might enjoy a holiday from drilling operations in order to make the critical materials such as steel used in such operations, available for other urgent needs.

Although the changes in the producing branch of the industry, up to the present, have been those of restriction rather than expansion and have been somewhat less spectacular than those of refining and transportation, production does have problems which are real and of continuing and increasing importance.

We are not finding oil fast enough and we have not found oil fast enough for the past four years to replace that which we have produced and consumed and so to maintain our reserves on balance. Now war changes our standards and our values. We are not concerned with this falling off in the rate of discovery for its effect on our reserve position. We are moved by the stern need to increase our daily productive capacity and the discovery of new pools in the quickest and most effective method of achieving such result at a minimum expense of manpower and of scarce and critical materials.

Analyses of the poor results which have attended our exploratory efforts over the past four years, probable causes, and urgent requests to increase the exploratory effort have been directed repeatedly to the oil industry by the Office of Petroleum Coordinator and by its successor, Petroleum Administration of War, during the eighteen months of their existence. These warnings and exhortations have been received by the industry with an understandable passiveness. During the entire period we have had and still have an excess capacity to produce. Why, one might argue, be concerned with the development of still greater capacity to produce while we still have a productive capacity of three to four hundred thousand barrels per day which can find no outlet. The answer is that part of this excess productive capacity, which is largely in the Permian Basin of West Texas and New Mexico, in the Gulf Coast of Texas, and in Southwest Texas, is not presently accessible because of transportation restrictions and that we have not yet had to meet our full war demand. The transportation problems will have to be solved in order that we can avail ourselves of our full productive capacity but even then, if estimates are at all correct, we shall need more oil than we are able to produce. In certain areas we shall face shortages in productive capacity within the very near future.

As our standards of value for reserves have changed to terms of immediately producible capacity instead of ultimately producible barrels of oil so have our standards of value for conservation. When we urge upon the industry the necessity for conservation in the production of known deposits we are considering the problem in terms of good production practice. We are not so concerned with a desire to conserve oil and gas to be produced twenty or thirty years into the future, although, other things being equal, this phase of the problem is not to be neglected. We are moved by the stern need to keep our daily productive capacity at the highest possible rate for the next two, three, and four years. The War need is paramount and it requires, we hope, the relatively short view.

Let us look at the basic problem—that of exploration. What is its status? In terms of effort, as measured by the number of wildcat wells drilled and by the number of geophysical and core drill crews in operation, and these are perfectly satisfactory indices, it is at an all-time peak. Over three thousand wildcat wells have been drilled annually for each of the past three years; a number greater than that during any other time for which records are available. In excess of three hundred geophysical and core drill crews were employed throughout the past year and are being employed at present, another record-breaking performance exceeding by more than 12 percent such prospecting activity for any previous year. We can only conclude that our exploratory effort is at an all-time high.

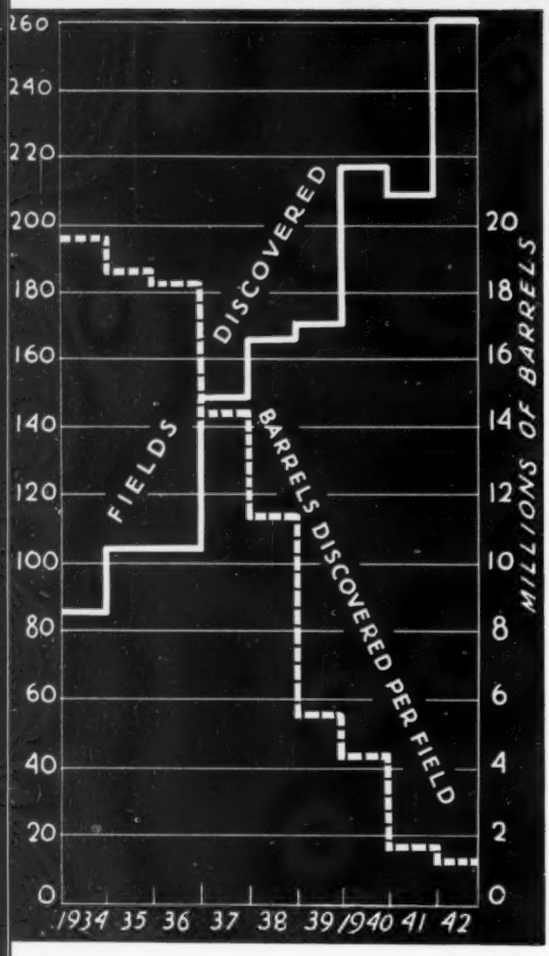
The results of this effort, however, are below our hopes and below our necessities. The results of exploratory drilling 1934-1942 are set forth in Table I. The most notable facts developed by this table are (a) the sharp falling off in reserves discovered annually since 1938, (b) the increase annually in number of fields discovered and, (c) the decreasing average reserves discovered per field.

Table 1.

Results of Exploratory Drilling.

Year	Total Wildcat Wells Drilled	Successful Wildcats	Number New Dields Discovered	Total New Reserves Disc.* Million Bbls.	Discovered Per field Million Bbls.
1934	——	—	86	1,699	19.7
35	——	—	104	1,934	18.6
36	——	—	104	1,894	18.2
37	2,224	222	148	2,119	14.3
38	2,638	294	166	1,894	11.4
39	2,589	224	170	943	5.6
40	3,038	302	217	945	4.3
41	3,264	503	209	361	1.7
42	3,045	493	261	317	1.2

* Revisions, extensions, and new horizons are credited back to year of field discovery.



Our real problem is probably that of the tremendous rate of consumption of crude oil and products at which we have arrived. There is nothing in the past history of our efforts at exploration for new fields to justify the belief that we can continue to discover indefinitely the almost one and a half billion barrels which we consume annually. If we review critically our past record of discovery we find that, except for the 1926-1938 period which I propose to call the geophysical period and which I shall discuss separately in greater detail, there were only two years in the whole history of the oil industry when we discovered as much as one billion barrels of reserves in a single year. One of these years was 1901, the year of Spindletop and other important fields of the Gulf Coast of Texas and Louisiana. The other year was 1921, the year of discovery of the great Long Beach, California, field.

During the geophysical period, the period of 1926-1938, except for the year 1932 and 1933 which were years of the depth of the depression, with regard to the oil industry as well as the national economy, we discovered well over a billion barrels annually. Even including these two bad years, thanks to the discovery of Oklahoma City, Kettleman Hills, and East Texas, none of which were geophysical discoveries, during this period we discovered an average in excess of two billion barerls annually. A critical consideration of this period suggests that prospecting was marked by our use of a new and highly effective prospecting tool, geophysics, and that during that period we discovered reserves which, lacking such prospecting device or one equally useful, it might have taken us 30 to 40 years or even longer to discover. Furthermore, additional consideration of the history of oil prospecting and particularly the continuous decrease in average size of fields discovered, suggests that we may be approaching the end of an era, that of prospecting for oil in structural traps, as well as the end of a period, that of the search for such traps by geophysical methods.

The nation, however, is interested in results rather than techniques. Again taking the short view imposed by war, what we require at present is increased productive capacity and our best chance of getting it is through the discovery of new fields. If they cannot be found at our present rate of exploration, efforts must be increased. The Petroleum Administration for War has recommended the drilling of 4,500 wildcat wells during the present year as compared with the 3,045 wildcat wells drilling during the past year. The individual companies are being approached and asked to discuss their prospects and their proposed exploratory programs and every effort will be made to step up our rate of oil-finding. The war has placed only one requirement on those engaged in petroleum exploration and development —to find more and more oil—of the right type and in available places—with less and less equipment. This statement is simple; it is the problem which is complex. Yet the problem must be solved.

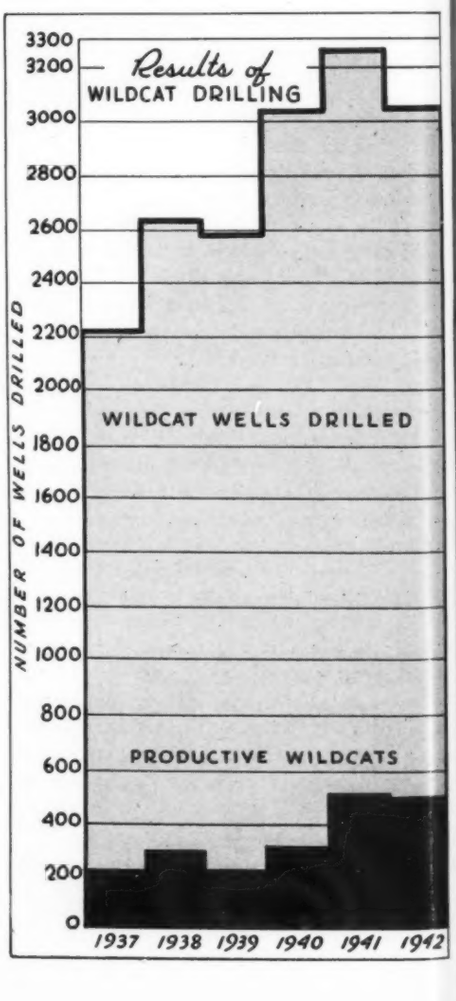
Lest I convey the impression that I am a pessimist, may I say that I believe that there are yet unknown fields of great magnitude still to be discovered within the United States. I refer to search for fields of the stratigraphic trap type to which the mammoth East Texas field and the great Coalinga deep fields belong. This, however, is Mr. Levorsen's thesis and I will not attempt to develop it. It is enough for my present purpose to say that at present we have no easy method of discovering such fields.

The business of exploitation of known deposits is not so difficult nor in such a bad way at present as is that of exploration but it also has its problems. The need for enormous quantities of steel to implement the war has made necessary drastic reductions in the normal rate of consumption of steel in oil field development. This necessity gave rise to Conservation Order M-68 which was issued on December 23, 1941, and which was intended to reduce the consumption of oil field supplies to 60 percent of that used in 1941 and to ration such reduced supplies to the industry. This order placed no restrictions on the all-important matters of geological and geophysical exploration nor on the drilling of wildcat wells. It granted automatically the drilling of one oil well properly located on each forty acres and likewise one gas well to each six hundred and forty acres. There were other automatic standards for the use of oil field equipment and, since it was realized that no set of general standards would suitably meet all cases, provision was made for the granting of exceptions as conditions require.

This order has performed its principal function admirably. During the year 1941 a total of 29,574 wells were drilled not including salt water disposal and input wells. During the year 1942, similarly 17,872 wells were drilled. The order was intended to restrict drilling in 1942 to 60 percent of the drilling in 1941. In performance it actually restricted drilling in 1942 to 60.4 percent of drilling in 1941.

Order M-68 was amended from time to time to meet special cases. The proposed drilling program for the present year is for 16,000 wells of which it is hoped that 4,500 wells will be wildcat wells. Obviously, as less and less material is available for drilling and as our needs for production mount, the operation of any restriction will have to be less automatic and more discretionary authority will have to be used.

A shortage of manpower in the producing branch of the industry threatens to become as important during the present year as is the material shortage. This condition, as well as the necessity for maintaining productive capacity, makes highly desirable the unitization of those fields where it would be most effective as well as to promote pressure maintenance, repressuring and secondary recovery programs and such unitization, the Petroleum Administration for War is prepared to promote to the full extent of its powers.



Core being removed from an inner core barrel on wire barrel coring.

SCIENTIFIC SYSTEMS OF SURVEY
Main Reliance for Discovery

Situation Calls for Intensified Effort, Selection of Appropriate Methods and Full Utilization of Accumulated Information.

WITHIN the past twelve months there has been a remarkable change in the status of United States petroleum reserves as a topic of public interest. In former years the annual estimates of such reserves attracted little attention either in or outside the industry. The figures were reassuringly stupendous — 15,000,000,000, 17,000,000,000, 19,000,000,000 barrels. Besides they seemed to grow steadily from year to year. Evidently there was no calculable limit to the country's oil resources and so nothing to worry about!

Here and there a few men who studied the subject observed that while discoveries continued to be made the additions to the backlog of oil supplies were growing constantly smaller. As many new fields were being opened but each field contained fewer barrels of oil. The number of dry holes per million barrels discovered was rising and the total footage drilled to provide a hundred million barrel addition to known underground stocks made an even more unfavorable comparison. These findings were put into papers, read before technical groups and published in the trade press. The downward trend was noted but nobody got excited about it. In the background of our minds was always that impressive 20,000,000,000 barrel figure to provide roseate prospect for the future.

Then came the war, bringing many changes. The United States became the arsenal of democracy—and the supplier of petroleum products to all the nations fighting against Totalitarianism. Soon we ourselves were in the war, up to our necks, with obligations to fuel a fleet of planes filling the skies, fleets of ships ranging the seven seas, and the whole vast mechanism of a war on wheels. One effect has been an astonishing shrinkage in the value of figures and of everything that figures represent. A thousand million means less today than a single million did yesterday. What does a billion signify? Are we not spending twice that much every week—a hundred billion to be spent during the year?

This huge reserve looks smaller too in comparison with the demands that are facing us, requirements hitherto undreamed of by the boldest imagination; oil is today the most decisive weapon in the great global conflict. It must be poured out in a flood that will drown the might of the Axis, a might that is turned to weakness by lack of this one essential. As a result the mountain is shrinking in size not only by comparison but in its actual dimensions. We have been finding less oil at the very time when we are called upon to supply more. To adopt a different simile, we have been making smaller deposits in our petroleum bank account while at the same time we have been issuing heavier drafts against it. As a result the balance to our credit is falling. Unless it is replenished it will continue to decline with increasing rapidity. This is the reality that is being brought home to the minds of government officials who have been oblivious to it heretofore. When a leading authority on oil who is at the same time a highly placed member of the war administration makes the statement that we are drawing measurably near to a shortage of oil in the United States the subject becomes one of real public concern.

When warnings long unheeded finally get a hearing it often happens that unwarrantedly extreme conclusions find expression. So it is that we are being told by pessimistic forecasters that little more oil remains to be found, that the methods of locating it are outdated and new ones must be developed, that the job is too big for private industry and should be taken over by the federal government, that subsidies should be paid for drilling all over the country on the possibility that chance discoveries may result. These are not the views of men who know most about oil and the problems of its discovery but they do reflect the attitude of some of the men connected with official agencies who in the past have been deaf to the need for greater reserves of petroleum but who now grasp at the chance of using the war as a means of setting up government management of industry.

In reality the situation confronting the American people, so far as their oil resources are concerned, is looked upon by those who have spent their lives in the study of geological conditions or in the practical activities of oil search as presenting the following features:

There is no reason to assume that the country's oil deposits have all been located or that new fields of first rate importance may not be found.

There is evidence in the decreasing size of the fields opened in the past few years that a greater amount of exploration will be required to make the additions to reserves that are needed to keep them at a safe level.

Nor is there any evidence to support the claim that scientific methods of survey have lost their efficiency. In fact the statistics of oil discovery show that the number of wells drilled on locations selected on a technical basis has continued to increase and the percentage of producing wells among those so located is consistently higher than in the case of sites selected by other means. The

(Continued on page 66)

WILDCATTING AND OIL RESERVES

By Fredric H. Lahee

Declining Trend of Discovery Shows Necessity of Increased Activity in Exploration and Drilling to Cover Non-producing Areas and Reach Deeper Horizons.

THE accompanying table and chart bring up to date, and to some extent repeat, the statistics published in this journal in March, 1942.* These statistics relate to eleven states which together account for a large percentage of the reserves and wildcatting activity of the country. These states are Arkansas, California, Illinois, Indiana, Louisiana, Michigan, Mississippi, New Mexico, Oklahoma, and Texas.

We wish particularly to emphasize the fact that not all the figures are exactly comparable. Most of them have been obtained from two sources; on reserves, from publications of the American Petroleum Institute, and, on wildcatting, from the Bulletin of the American Association of Petroleum Geologists. However, the figures underscored, under 1942 and 1943, in Table 1, are taken from the statistics recently published by the Oil Weekly.** These include data on both wildcatting and reserves, and, although they are probably close to the figures which we shall eventually use for our final 1943 review on this subject, they will not be identical.

In our paper last year* we defined a wildcat, and we explained methods of estimating oil reserves. There is no need of repeating these topics here. The main point brought out by the paper a year ago was the declining rate of discovery. This year the same conclusions hold true. Discovery rate has been trending downward, and this at the very time when there is every reason for increasing reserves.

There is a tendency among those who do not fully understand the business of finding and producing oil to assume that the country's total proved reserves of some 19½ billion barrels can be dipped out at any time at any rate. They do not realize that this reserve cannot be drawn out like water from a tub. These 19½ billion barrels are available at rates of delivery not much greater than recent production rates. With few exceptions excessive withdrawals would last for relatively few days, and would result in permanent loss of oil which might otherwise, at efficient rates of production, have been brought to the surface of the ground. So, when we read that there are 19½ billion barrels of oil "in sight," let us remember that this much oil can be actually produced for utilization only through a long period of years.

We may perhaps best close this brief paper by quoting from our article of a year ago: "Remaining undiscovered reserves are largely either (1) in regions not yet explored; or (2) they are in reservoirs deeper than those reached on already exploited structures and often unconformably related to the strata that contain the known reserves; or (3) they are in reservoirs of the stratigraphic pinch-out type, which can seldom be located by surface observations.

"To look for oil under the first of these conditions will need increased activity in exploration and in drilling in areas which do not now produce oil, but which are rated as having some prospects. To look for oil under the second of the conditions just mentioned will require deep wildcatting and also deeper drilling on known structures or within the confines of known pools. To look for oil under the third condition will require the drilling of many holes, some of which may be purely informational, but all of which will help in locating the positions and trends of subsurface stratigraphic pinch-outs. If we are to maintain a satisfactory discovery rate, as applied to new reserves, we must become more vigorous than heretofore in our wildcatting campaign. We must show a strongly rising curve in the annual number and in the annual average depth of wildcat operations."

*WORLD PETROLEUM, March, 1942, pp. 54-56.
**_Oil Weekly_, Vol. 108, No. 9, Feb. 1, 1943, pp. 50, 68.

Footnote to chart:
Statistics for 1937 to 1941, inclusive, from Bull. Am. Assoc. Petrol. Geols., Vol. 26, No. 6 (June), 1942, p. 980. Statistics for 1942 from Oil Weekly, Feb. 1, 1943, pp. 50, 68.

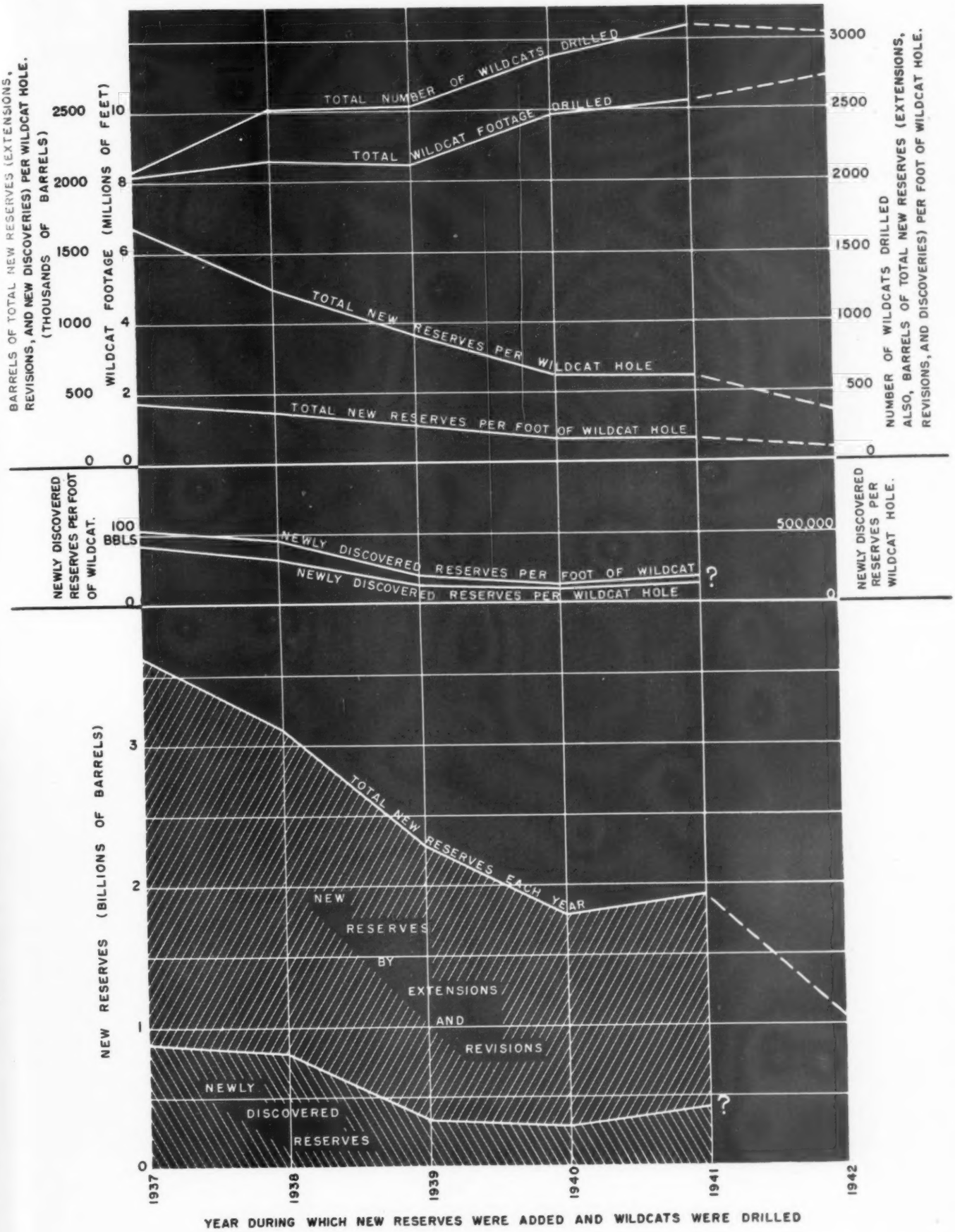
TABLE I

*Statistics on Proved Reserves in Area of Eleven States**

	1937	1938	1939	1940	1941	1942	1943
A. Proved reserves As of Jan. 1 of year indicated	12,241,885,000	14,664,035,000	16,630,452,000	17,723,393,000	18,226,542,000	18,816,785,000	18,588,362,000**
B. Net change in proved reserves since Jan. 1 of previous year		+2,422,150,000	+1,966,417,000	+1,092,941,000	+503,149,000	+590,243,000	-228,423,000**
C. Total new proved reserves added	3,635,946,000	3,118,649,000	2,293,496,000	1,786,698,000	1,920,161,000	1,078,745,000**	
D. Production during year indicated	1,213,796,000	1,152,231,000	1,200,555,000	1,283,490,000	1,329,918,000	1,307,168,000**	
E. Years of remaining proved supply of Jan. 1 of year indicated, based on production of preceding year	11.74 Yrs.†	12.08 Yrs.	14.43 Yrs.	14.76 Yrs.	14.20 Yrs.	14.15 Yrs.	14.22 Yrs.
F. Total number of wildcats drilled	2,147	2,507	2,525	2,871	3,089	3,045	
G. Total wildcat footage drilled	8,191,241	8,602,756	8,451,819	9,813,511	11,245,401	10,938,908	
H. New proved reserves (C) per wildcat hole drilled in year indicated	1,693,500	1,243,976	908,315	622,326	621,612	354,267**	
I. New proved reserves (C) per foot of wildcat hole drilled in year indicated	443.88	362.52	271.36	182.07	170.75	99.0**	

* This area includes Arkansas, California, Illinois, Indiana, Kansas, Louisiana, Michigan, Mississippi, New Mexico, Oklahoma, and Texas. All figures are in barrels, except under items E, F, and G.
† Production in 1936, 1,042,464,000 barrels.
** Basic figures, italicized, from Oil Weekly, Feb. 1, 1943. (Vol. 108, #9, pp. 50, 68).

STATISTICS FOR ELEVEN STATES


BARRELS OF TOTAL NEW RESERVES (EXTENSIONS, REVISIONS, AND NEW DISCOVERIES) PER WILDCAT HOLE.
(THOUSANDS OF BARRELS)
WILDCAT FOOTAGE (MILLIONS OF FEET)
NUMBER OF WILDCATS DRILLED
ALSO, BARRELS OF TOTAL NEW RESERVES (EXTENSIONS, REVISIONS, AND DISCOVERIES) PER FOOT OF WILDCAT HOLE.
TOTAL NUMBER OF WILDCATS DRILLED
TOTAL WILDCAT FOOTAGE DRILLED
TOTAL NEW RESERVES PER WILDCAT HOLE
TOTAL NEW RESERVES PER FOOT OF WILDCAT HOLE
NEWLY DISCOVERED RESERVES PER FOOT OF WILDCAT.
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NEWLY DISCOVERED RESERVES PER WILDCAT HOLE.
NEW RESERVES (BILLIONS OF BARRELS)
TOTAL NEW RESERVES EACH YEAR
NEW RESERVES BY EXTENSIONS AND REVISIONS
NEWLY DISCOVERED RESERVES
YEAR DURING WHICH NEW RESERVES WERE ADDED AND WILDCATS WERE DRILLED

ASSURE OIL FOR VICTORY

BY PRESERVING SMALL PRODUCERS

By AMBROSE PARTRIDGE*

WAR FORCES on us grim realities; it makes us face essentials; imminent death demands that life consider only the soundest of fundamentals. The vital necessity of providing supplies of petroleum for our armed forces, for the production of the sinews of war, and for the preservation of our "American way of living" calls for a judicial evaluation of those factors which prevent this nation from obtaining adequate supplies of oil.

Proponents and opponents of various measures have discussed these matters with much heat and with some light; let us avoid emotional prejudices and try to achieve a judicial appraisal of the entire matter, difficult as it may seem to be, under the present circumstances. Oil producers have presented arguments to governmental officials which seem adequately to substantiate the imperative need for, and to explain the proven methods of, getting more oil.

Yet some governmental officials—outside of the province of the Petroleum Administrator for War, have been unmoved to any constructive action and have chosen by their inactivity for 21 months—16 months of war—to do nothing until last month's decision, which was "No price rise in crude oil."

The petroleum producers have presented data on the merits of the case, offering facts on "declining production per well," "reduced number of wells," "inroads on stocks," "anticipated future demands," "excessive costs over selling prices"; these data have referred to the mathematics of the case. Temporarily let us forget the "unavailability of steel," and "economic aspects of a price increase for crude oil," and let us direct our attention to fundamentals.

We believe that the whole matter, of obtaining increased production of crude oil, automatically resolves itself into two simple questions which can well be asked of government officials: "Do you agree that we need more oil to win this war?" "If so, what is universally recognized by industry and government as the quickest, soundest, most effective proven way to get more oil, more tanks, more planes, more anything?"

Let us forget the oil industry for a moment. When our government was faced with the necessity of increasing the production of planes, tanks, guns, and munitions, and sought the patriotic cooperation of private industry, what patterned procedure did these government officials follow?

1. They immediately expanded the existing production facilities three or four times (with or without governmental financial help).

2. They appropriated scarce steel to build huge new plants to provide two or three times as many munitions plants as formerly.

3. They set government contract prices high enough to offer a compelling incentive to private capital to convert its peace-time facilities to the manufacture of war products. Above all else, the government arranged ample margins for industry to pay all development and production costs, and to keep for itself a reasonable profit, after taxes.

Why was this identical procedure followed for every company in every war industry—except for oil producers?

Despite the universally-recognized need for oil, which should have compelled the use of all possible means to stimulate increased oil production, what happened to the oil industry?

(1) In spite of the industry's best efforts, "production per well" declined, due to the normal natural decline in oil production, and due further to the fact that many wells had already been producing at volumes close to their maximum. So, "production per plant" was not multiplied, as in other industries, but actually declined.

(2) The number of "producing plants" was not increased two or three times, as happened in other industries. Actually, the number of "producing plants"—wells—was reduced by two causes:

(a) The low price for crude oil, set by government officials, caused the abandonment of small producing wells—"strippers," to obtain the second-hand material which offered the only hope of getting any financial return on these low-volume wells, which are the backbone of the oil industry.

(b) A governmental order actually decreased by 40 percent the number of wells to be drilled from 30,000 in 1941 to 18,000 in 1942.

This latter regulation was decided upon by the best judgment available at the time, as a measure to conserve steel for other purposes, with few purposes as vital as oil production. This reduction has placed a severe strain on the oil industry which each year must naturally add "production plants"—wells—as sources of raw material, at the back door of the industry in order to supply an increased volume of finished products at the front door.

It has been properly claimed that these two governmental regulations have caused a tremendous setback to the oil industry, because thousands of producing wells have been abandoned, thereby eliminating them as a source of oil, and thousands of wells, which normally would have been drilled, were not drilled, thereby eliminating them as a source of oil. These twin difficulties have left the industry ill-prepared to face the present and the future—with decreasing production to meet increasing consumption.

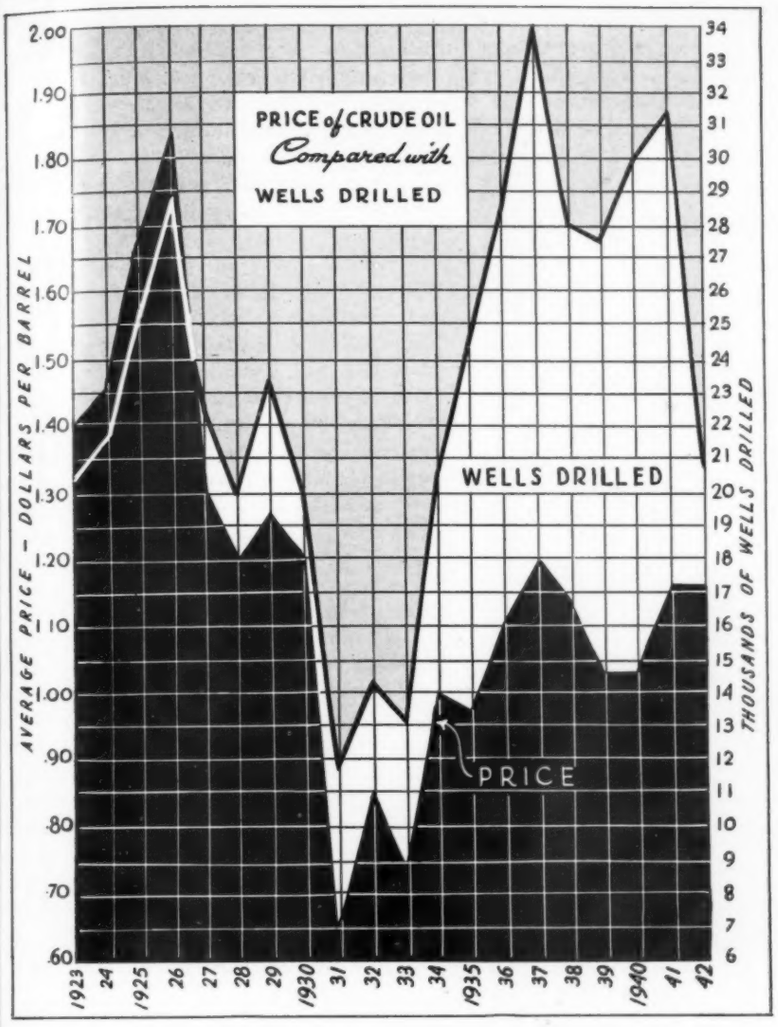
It was stated that the amount of steel saved, by not drilling the necessary wells, would build 26,000 tanks and half a million 2-ton bombs. Even if the steel had been devoted to building 26,000 tanks and half a million bombs, many still doubt that such a choice was a wise trade—abandoning the production of oil to make equipment which is useless without oil.

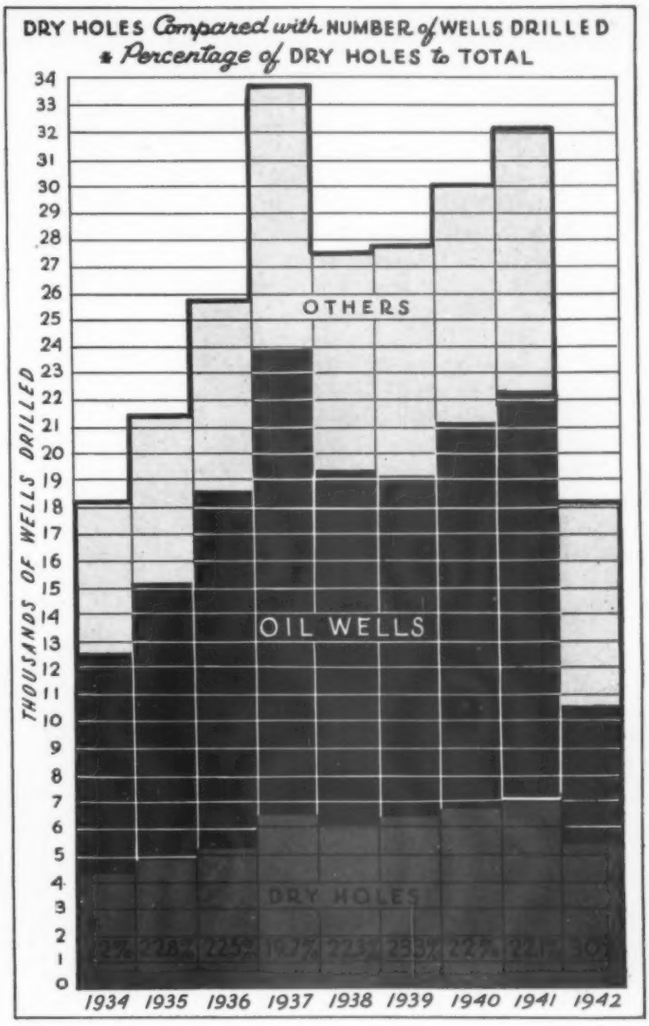
Information indicates, however, that the steel was used by other governmental officials to construct more new buildings, when industry already had plenty of buildings, which were not being used to capacity. Mr. Charles E. Wilson, that forceful, dynamic president of General Electric Company, now vice chairman of WPB, finally precipitated a fight to force the Army to cease putting up more new buildings with steel more needed for more important war work. Mr. Wilson showed that even the most efficient of the Army suppliers were operating their present buildings only at 61 percent of capacity.

What about the 18,000 wells which were drilled? From reliable sources, it is indicated that their "production per well" was much less than the "production per well" of former years. The picture is this: Government officials cut the number of new wells almost in half, and the "production per well" was materially reduced, so the industry added, in 1942, only a fraction of the amount of oil it would add under normal circumstances—and much less than is needed to satisfy war demands — under the pretext that steel is more needed elsewhere than in providing oil—an assumption which time is rapidly helping to prove unsound.

3. Prices for petroleum and its products were not set in line with the increased costs of production, as was done in other industries, where no

* Pseudonym adopted by the author who is a nationally known oil executive.





manufacturer of guns, planes, tanks or other war equipment, was told to increase his original output or make new equipment, unless the price stipulated by governmental officials fully compensated him for all his expenses and allowed him a profit. No, the oil industry was told to increase its production, at a low peace-time selling price, fixed by government edict, which took no consideration of the changed circumstances created by the war, which allowed for no increased expense for labor, material and taxes, and which provided for no profit accruing to the individual, as was allowed to every other company in every other war industry, and, above all, which offered no incentive to meet war's demands to get more oil now.

Proponents of a price increase urge that the newly-appointed governmental officials imitate the procedures followed by officials of the Army, Navy and WPB in dealing with other industries, and recommend that they adopt a program for the oil industry which embodies the following features:

1. Recognition that provision of adequate supplies of petroleum and its products is one of the most important responsibilities for the success of this war, and that government's job is to help, not hinder, the discharge of that responsibility.

2. Provision of materials and equipment in such reasonable quantities as to assure the oil industry of the facilities to produce, transport and refine the necessary volumes of petroleum and its products.

3. Determination of a price for crude petroleum which is adequate to: (a) Provide an incentive for the average producer to risk his capital in "wildcatting" for the oil; (b) Cover the expenses of production from "wildcat" or development wells; (c) Maintain the production of "stripper" wells; (d) Develop production of oil by "secondary recovery" methods (into which stage the American petroleum industry is rapidly entering); (e) Yield, under all the above conditions, a small profit to the producer. (Any excess profits will be removed by taxation.)

4. Determination of prices for refined products which will compensate for all expenses and allow a small, legitimate, war-time profit to the refiner and the marketer.

* * *

Who have recommended that action be taken to provide this country with oil?

1. President Roosevelt. On November 10, 1942, in his letter to Judge William P. Cole, Jr., on Mr. Cole's accession to a Federal Judgeship and his resignation as Representative and chairman of the House Petroleum Subcommittee, President Roosevelt wrote:

"The crucial importance of oil in the winning of the war cannot be overestimated. As you have so clearly pointed out, petroleum has made total war possible, and the assurance of adequate supplies of this fighting fuel for our combat troops and for war industry is indispensable to victory.

"In view of our greatly increased requirements for oil and its products, the problem of maintaining adequate petroleum reserves takes on an added significance. The immediate discovery of additional sources of oil is imperative."

2. Judge Cole, whose nine years of work as chairman of the Petroleum Subcommittee had won for him recognition as the one man, outside the industry, best-informed about oil matters and by all odds the best-informed within the government. In his masterful report to the President

Judge Cole presented a complete panorama of the petroleum problems of this nation—at war and in the post-war period. In part, the Cole report said: "We are certainly headed toward disaster, Mr. President, if we cannot make provision at this time, for an increased supply of nearby petroleum.

"With our present transportation and our present rate of discovery, showing any regard for conservation, we shall be short of oil within two years.

"The time lapse between the search for petroleum and its use where needed, is at least two years. If we knew that one-fourth of our iron furnaces or steel mills would be out of commission within two years, and it took two years to build others, we certainly would do something about it. Oil is more surely a war product, and a more important one than steel, guns, armament, or explosives, and we do not restrict their production by price.

"An adjustment in the price of oil and a collateral adjustment in the prices of products is a necessary war measure to insure the drilling of 'wildcats', to continue production of 'stripper' wells, to rehabilitate wells long shut down, and make possible secondary recovery operations in many fields when the oil is needed.

"It is illogical and as silly to place a blanket price on oil below the cost of production, which will inevitably cause a deficiency in this product and may cause us to lose the war, as it would be to say that we will not pay a different price for tungsten, even though we cannot furnish our troops with arms without its use.

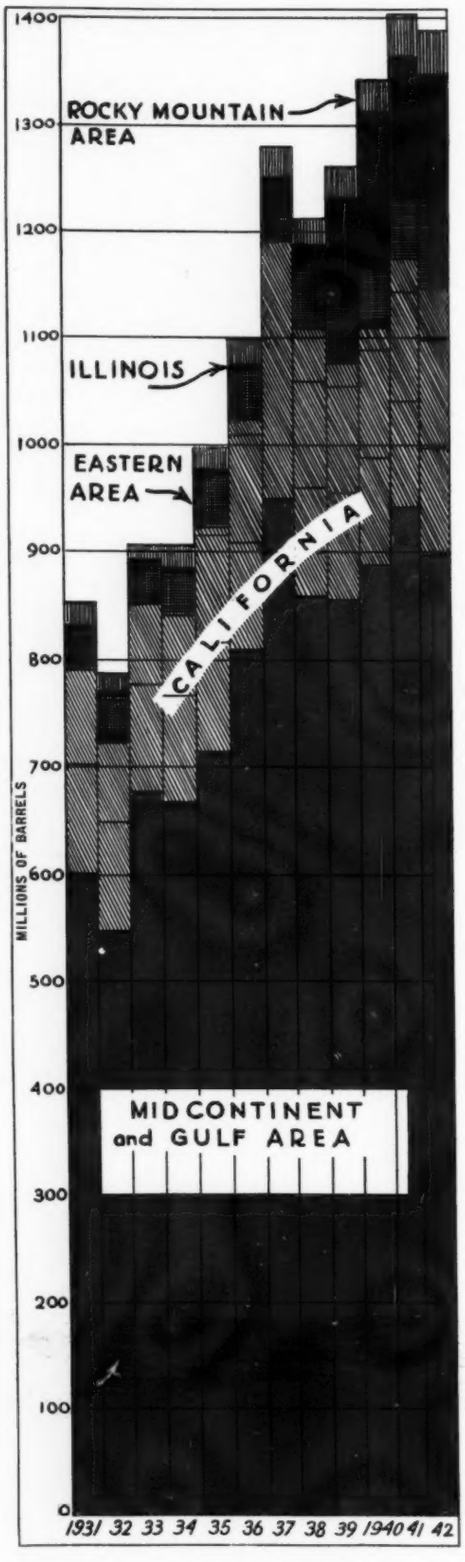
"The cost of finding and producing oil is greater than the price for which it sells. No kind of legerdemain or cajolery will induce practical men to invest capital, where, on the average they cannot expect to get their capital back."

3. Report on December 31, 1942, of the Petroleum Subcommittee of the Committee on Interstate and Foreign Commerce of the U. S. House of Representatives, Clarence F. Lea, Chairman. In part, it follows:

"The importance of new discoveries is so great that necessary incentives to accomplish them must be established. The difference between oil and the lack of oil for military purposes is so great that it emphasizes the fact that oil has a value much beyond its production cost. In fact, oil, as measured by its useful value, is one of the cheapest products money can buy.

"The facts tend to show that practically every barrel of crude disposed of at our wells today is sold at a price below replacement costs.

"Oil has been coming from the easier sources where quantities were most available and costs at a minimum. The industry must turn to locations more difficult and costly to find, to more expensive production, to the increased cost of declining pools and stripper wells, to the increased cost of drilling and recovery. Now we face an abnormal demand which can be met providently only by positive aggressive action without delay and controlled by experienced men.



"The number and operation of practically military equipment is limited by the supply of petroleum products which can be delivered point of use. We have the choice of our production of petroleum or decre military plans to conform to our oil supplie This fact simply illustrates the impor nce positive aggressive action to increase our oil plies.

"It appears the (producers and) refi given a ceiling at prices below their cos duction. Is this a wise governmental policy, think it is not. The citizen should bear h of the expenses of government through ta exact property below the cost of produc not a just policy and may well serve as a cap to our war effort where it applies to critical war material. A fetish should not be made price ceilings to stand in the way of reasonable adjustments justly due producers. This normal incentive to production should not be withdrawn from critically needed war materials. Such policy is not only unjust but is also an unnecessary hazard to war production. A just price ceiling for crude is of even greater importance.

"The independent producer has been a valuable asset to petroleum discovery and development. Dealing principally with the production of crude he lacks the security of producers who also engage in transportation, refining, and distribution. In this diversity of business there has been a protection against losses in one line of industry while others may prosper. The independent producer should be given proper encouragement."

The two most important aspects of this whole problem seem to be: (1) The determination of a fair price necessary to be paid to assure production of the crude oil, and (2) The availability of the necessary materials to be used in producing and transporting the oil.

Let us examine the subject of price.

1. In July, 1941, Phillips Petroleum Company applied to the Office of Price Administration for permission to increase the price of Mid-Continent crude by 25 cents per barrel. OPA requested that action be deferred for 90 days pending a study. Nothing resulted.

In October, 1941, three months after Phillips' request, the Independent Petroleum Association filed a brief with OPA, outlining the necessity for increased crude prices. The Administrator two months later, in December, 1941, asked the Tariff Commission to investigate the cost of producing petroleum for 1939, 1940 and the first three quarters of 1941. Now, 21 months after Phillips' original request to the OPA, the Tariff Commission, with the assistance of the OPA, issues its long awaited report, and, on the basis of the Commission's report, the OPA immediately denies the unanimous request of the oil industry for an increased price for crude oil.

oil producers properly contend that this decision jeopardizes the existence of "small business ...in the oil industry; it definitely prevents ...tion from obtaining adequate supplies of ...necessary for fuels, lubricants, aviation gasoline, toluene, butadiene, and other vital production. This may prove the beginning of our next ...national scandal.

...e following comments are pertinent to the ...ff Commission's report on "Crude Petro...": (A) The Commission expended much ...e and effort gathering data on oil production, ...lumes, and costs, which are difficult to obtain; ...this the Commission deserves commendation. ...the report are assembled some useful data, ...ich may be used as part of a more comprehensive and factual study. Unfortunately the poor mechanical presentation of the report will undoubtedly reduce the wide circulation and intensive reading which it deserves.

The report presents a most plausible case, supported with much valuable data, demonstrating that crude oil prices should not be increased. The report's glaring weakness, however, is that it did not go far enough, either in time or in subject matter. It did not deal with the operating conditions of the vast majority of the wells in this country; it did not deal with current war costs; it did not consider the inevitable future of the present wells; it did not consider our country's dire need for oil to perpetuate its existence in war and in peace. These omissions prevent the drawing of logical, factual conclusions from this report.

(B) Any report is not true and valid which: (a) fails to consider and reflect the operating conditions surrounding 30 percent of the production from 49 percent of the wells owned by 87 percent of the oil producers; (b) fails to allow for differences in operating conditions, varying so greatly even among the 13 percent of the producers, producing 70 percent of the oil, who were considered in the report; (c) starts back three years for data and then consumes one and a quarter years to present them; the age of these data varies from 4¼ to 1½ years—none of them is current. The data were already invalid and unrepresentative when the report was started in December, 1941, because the war had begun to change every industry; now, 1¼ years later, these data are only historical, and have no current value in determining today's war costs in 1943.

(C) The present net costs listed in Table 1 of the report are the costs at which four tenths of one percent (26 out of 20,000) of the producers produced, in 1941, 50 percent of this country's oil. But oil was available then, and still is available, from the other 99.6 percent of the producers who daily produce 50 percent of the oil. Our nation needs every drop of oil it can obtain, particularly from this 99.6 percent of the producers. but the government, in all fairness, should not compel these producers to produce oil at a loss and thereby confiscate their capital and liquidate their business.

If the OPA, guided by this report, sets its ceiling price for crude oil at that price which allows only 0.4 of 1 percent of the producers to continue to operate, what is to become of the 99.6 percent of the oil producers who cannot operate at these low prices? Is the government going to crush them out of business and deprive them of their livelihood on which they have spent many years?

(D) The 400,000 oil wells in this country produce 3,800,000 barrels per day—an average of 9.5 barrels per well per day: 88 percent of these wells—363,000—are pumpers; 315,000 of these pumpers—87 percent—as classed as "strippers," marginal wells whose income too frequently does not equal their operating expenses, because the government compels the producers to sell their oil at such a low price that the producers barely cover their costs. Each day dozens of these wells are being abandoned because the low prices for crude oil prevent continuing their operation. Nearly 10,000 wells were abandoned last year; over 72,000 were abandoned in the last eight years of government contact with the oil industry.

Authorities estimate that only one-third of the total oil in a well is recovered by primary production methods (from the stages of "flush," then "pumper," then "stripper") and another third is available by secondary methods. As time passes, every well gets older, ultimately reaches the "stripper" stage and suffers abandonment or yields increased oil by secondary recovery.

Under the present price ceiling of the OPA, more wells each day enter into the "stripper" class and more "stripper" wells are abandoned. Today's profitable wells become tomorrow's "strippers" and the next day's abandoned wells.

(E) The present 315,000 "stripper" wells produce over 200,000,000 barrels of oil a year—an average per well of 1.93 barrels per day, of 705 barrels per year. Each well's output is small but their combined total production supplies more oil to the United Nations than did Russia, or Venezuela, or Mexico, or any other country outside the United States, in the last pre-war year. In these war-hungry years, we look with hopeful eyes toward each of these other oil-producing countries, while our "stripper" wells, which the present price ceiling is causing the oil industry to abandon by the tens of thousands, produce more than any one of these other countries.

These "stripper" wells produce an amount of oil equal to two months of each year's total supply. Since this nation needs every drop of oil it is possible to produce and transport, what would our nation do for oil during these two months if we continue each day to shut off the production of more of these "stripper" wells? Shall we shut down our industries and our living for two months? Shall wes stop the war for two months? Hitler has sacrificed millions of lives and dollars in a vain effort to obtain from the Russian Caucasus much less oil than these "stripper" wells produce each year in this country; and yet the present price ceiling accelerates the abandonment of this precious oil.

(F) The report makes no allowances for the additional costs which the individual producer assumes to develop "wildcat" wells, to drill eight holes to get one producing well. It presents a table showing that only 23 percent of the wells drilled failed to produce oil; that figure of 23 percent includes "development" wells on proven acreage, and does not represent "wildcat" wells alone, which have a record of successful completion of perhaps 13 percent.

The costs shown in Table 13 of the report under "General Overhead and Administrative Expenses" included the costs for "wildcatting." Dominant consideration, however, was given in the report to the costs of the larger oil producers most of whom have also facilities for transportation, refining and marketing, and to whom production is only one of several functions; "wildcat" wells represent a comparatively smaller percentage of their total production operations, whereas "wildcat" wells, with all their hazard and extra costs, represent a considerable share of the total operations in the sale function of the industry conducted by the average individual producer.

Anyone familiar with the oil industry knows that 75 percent of the "wildcat" wells are promoted and developed by individuals. The preliminary geological work, the acquisition of the leases, and the assembling of the area is most frequently handled by an individual. After the program is assembled, the individual "sells" part of his "deal" to various oil companies for varying considerations, all of which involve financing and assistance of some character. The creation and promotion of the plan are done by the individual; much of the financing is done by the oil companies.

The Tariff Commission's report omits any consideration of these factors and excludes these necessary individual producers who, with others, constitute the 87 percent of the oil producers who were not considered in this report.

(G) It has been estimated authoritatively that these present "stripper" wells contain over 4,000,000,000 barrels of oil. Abandonment of these wells will lose for this nation an amount equal to three years' total national oil production at our present rate, because it will eliminate them from secondary recovery. Can we afford to be so prodigal with our oil as to discard three years' production? And yet, these present low prices of the OPA are doing exactly that—throwing away 4,000,000,000 barrels of oil available from these small wells by present production methods and by secondary recovery.

(H) The fundamental difference between the conclusions of the Tariff Commission's report and the conclusions of experienced oil men is that the price for crude oil should be based not on the most efficient operator's lowest cost of producing today a barrel of oil but rather should include the cost of keeping the majority of this country's oil wells alive and functioning, not only as sources of today's oil but as sources of next year's oil (when oil will inevitably be scarcer and higher-priced) and should also include adequate compensation for the extra cost and risk incurred in developing new sources of production.

This latter contention, implemented by facts, is based on the realization that our present oil production is not enough to support our war needs and the remnants of our civilian economy. Industry, and government, therefore, must adopt all means to keep in production this country's presently producing wells, obtain all available oil from them, and must continuously develop new sources of additional oil for our present and future needs. The cost of crude oil, therefore, should be determined as the cost necessary to keep the maximum number of wells producing the maximum volume of oil for the maximum length of time by all methods possible, and must include adequate margins to provide additional supplies. The cost of oil cannot, with any measure of reason, be set arbitrarily by the government as the cost for the most efficient producer to produce oil most cheaply from the fewest number of today's wells, and cannot be set so low that it takes no consideration of the additional cost to provide necessary continuous supplies for the future. Failure to consider adequately this fundamental distinction—which might be novel to the OPA and the Tariff Commission—is the basis of the erroneous conclusions contained in the report of the Tariff Commission.

(I) The entire report of the Tariff Commission and the present attitude of the OPA seem to run counter to the publicized philosophy of our country for the past ten years; the oil industry contends that the OPA is attempting to crush the "small business man"—the individual producer—out of the oil industry.

The NRA was evolved to protect the small business man; it raised prices and provided an "umbrella" to shelter the weak and the strong. The WPA sheltered those who were no longer employed or employable. While much boondoggling and leaf-raking resulted, and, in some cases, debased political advantage was taken of human misery to produce millions of votes at a cost of billions of dollars, much social value in the rehabilitation of human beings, and much more economic value in the reconstruction of business, resulted.

The "ill-fed, under-nourished, poorly-housed one-third of our people" has been emphasized for ten years; "marginal" human beings and their activities have been the recipients of most of our government's beneficial attentions. They have been maintained in business, at taxpayers' expense, in violation of all laws of economics, the competitive system, and the customs of the human race from the beginning of time. And, much good has resulted.

Now, the OPA, through this Tariff Commission report, gives consideration not to "the common man," not to "the marginal producer," but only to the top 0.4 of 1 percent of the oil producers —and dictates that those oil producers of the remaining 99.6 percent, who cannot operate as cheaply as the 0.4 of 1 percent must ultimately have their business confiscated by their own government. Curious oil men wonder: Why this attitude on the part of the OPA? Why does OPA want to "reform" the "reform movement"? Why apply the harsh policy of "survival of the fittest" only to the oil industry? Why try to prevent these "small business men" from producing oil from their own wells, when our country so vitally needs all oil possible? These oil men contend that if we need oil, why not use the proven, effective methods used in the oil industry in the past war, and used by the OPA and other government departments in this war, to stimulate production in every industry except the oil industry?"

* * *

No matter what the equitable decision might be regarding a price increase for crude oil, the answer to this problem of obtaining the oil which the "small business man" produces, at somewhat higher cost that his bigger competitors, is emphatically and definitely not a subsidy. No one who has studied the question wants a subsidy, not even the proposed recipients of the subsidy—the oil producers themselves. The government has never before known of proposed recipients of governmental subsidies being opposed to receiving them. That reason alone should convince the OPA that a subsidy is most unsound. The use of a subsidy would precipitate such a parade of chiselers and promoters to the OPA offices that even Washington would be startled and swamped. Every "sharper" who could beg, borrow, or steal some acreage would try to start a "wildcat" on it; he would have everything to gain and nothing to lose. If it was a well, he would sell his oil to the government; if it was a dry-hole, the government would pay for it.

Charges of favoritism and political patronage, and undoubtedly scandals, would follow in the wake of subsidies, and the final cost would be tremendous. Some subsidy payments would be made for worth-while promotions, but the "pork-barrel" instinct seems to have been so successfully inculcated in this country by the government in recent years, that undoubtedly many projects for wildcat drilling would be submitted to OPA which no self-respecting wildcatter would dare to submit to experienced oil men for their financial participation. The resultant cost would be colossal, with much of the money spent to purchases not oil, but "dry holes."

The present producer, being a small business man, would fear contact with any Washington bureau, he would go his own way, pulling and abandoning wells where he could not make them "break even," and trying to drill occasionally, without the opportunity for success and profit, to which he has been accustomed.

The total result would be millions of dollars paid out by OPA as subsidies, at one end of the production function in a vain attempt to add oil, from promoted, imaginary, non-existent wells, while, at the other end, the producers, continually losing money, because of the low price for crude oil, shut down actually producing wells—more dollars out and less oil in.

Of subsidies, Judge Cole wrote in his report to President Roosevelt:

Of the "bonus-for-new-well" subsidy: "Such an offer would not be sufficient incentive, unless the amount of the bonus was disproportionately large. The discovery would not add materially to the nation's reserves, because, once discovered, unless the wells were large, the field would not be developed under the present price of crude oil."

Of the "percentage-of-cost-of-dry-hole" subsidy: "It is a payment for failure, bad judgment, or incompetency, and subject to the further objection that an operator would be encouraged to plug and abandon small wells to secure the bonus."

"Subsidies," Judge Cole comments further, "are subject to endless delays and hazards of favoritism."

* * *

The obvious answer to this problem of increased payments to oil producers is to eliminate any further consideration of a subsidy and to raise the price of crude oil enough to cover the cost of producing as much oil as the country needs plus a small wartime profit to the producer. All authorities agree that it is most inequitable and it is confiscatory for the government to set a price for crude oil or any other commodity below the cost of producing it; it is most indefensible when the government's own data indicate that the price set is much below the cost of production.

The average figures set by the Tariff Commission's report for the year, 1939, 1940 and three-quarters of 1941 represent the then cost price for producing about 50 percent of the oil by 0.4 percent of the producers. If OPA uses such data to fix the price for crude oil, it can justly be claimed that OPA is confiscating the business of the individual producers who produce the remaining 50 percent of this country's oil.

It cannot truthfully be stated that an increased price for crude oil would enrich the large oil companies—"the majors." Of the 18 integrated oil companies—having production, transportation, refining and marketing—with each doing an annual business of over $50,000,000 per year, 14—

and they represent the largest companies—must buy crude oil—from 20 percent to 99 percent of their crude oil requirements—from other smaller producers because they do not produce enough oil themselves; a rough average for the whole group is that they buy two barrels for every one they produce. A price increase would actually cost these oil companies millions of dollars.

Besides, almost all of whatever profits might result from equally necessary but smaller increases in the prices of refined products, would return to the government as taxes. A recent study shows that the ratio of net income to invested capital for these "major" oil companies was 26.4 percent less than the average for over 1,100 other companies in other industries, for eight pre-war years, and now undoubtedly is further reduced by increased war costs and fixed price ceilings.

Some few opponents of a crude price increase propose a change in approved accounting practices regarding the handling of depletion allowances and intangible drilling costs. Such depletion allowance is common to all mining operations—coal, copper, zinc, sulfur, lead, iron, etc.; it represents a percentage of depletion determined and proven by experience as necessary and equitable to provide for the continued "liquidation" of an irreplaceable fluid asset. The allowance for oil is slightly higher than for coal, copper, zinc, lead, iron, and sulfur because while coal, sulfur and the metals remain stationary after discovery, the fluidity of the oil allows it to flow away from the producer's property.

The reduction of the depletion allowance would perform no useful service now toward increasing production but would only serve to precipitate additional financial problems for the industry. Above all, tampering with the depletion allowance for the larger oil companies would not solve the present problem of providing a price for crude oil adequate to defray the production costs of the small producers. The larger oil companies are already spending millions of dollars each year attempting to discover new reserves of oil. On the other hand, the small producer—producing 50 percent of this nation's oil—needs a higher price for crude because the combination of the present ceiling price and the depletion allowance per barrel on the small number of his barrels of production does not yield enough total dollars to enable him to pay his costs of production, amortize his investment and have enough dollars left with which to "wildcat" for new reserves of oil.

Any suggestion, at this time, to change such depletion allowances for the various mining industries such as oil and coal displays, in the words of the House Petroleum Subcommittee, "a lack of that sympathetic understanding which is essential for the proper encouragement of production, and shows a lack of coordination in high places of government."

Efforts to change now, during this critical war period, a 25-year old proven successful practice which was started during the last war to encourage production and has benefitted this country ever since, would prove a distinctly unpatriotic dis-service to our nation. This is so, not only because the imminence of its reduction would undoubtedly retard production—since the production of "mined" products requires ample depletion allowances and cannot be conducted without them—but also because the discussion of any such suggestion to remove so important a support for their operations would distract the executives of all companies in various mining industries from their main task of producing vitally-needed products to win this war.

Opponents of a crude price increase state that an increase would cause inflation. That argument is specious, because the same authorities—OPA—which limit the price also limit the distribution of petroleum products to consumers. Inflation arises by having surplus dollars in consumers' hands and surplus commodities available for purchase by consumers. No one can soundly believe that petroleum products could add to inflation, because rationing prevents consumers from obtaining the products. Where the consumer cannot obtain the products, there can be no inflation caused by those products.

Judge Cole, in his report to President Roosevelt, commented:

"With the restrictions which are now going into effect on the unessential uses of petroleum products, all oil consumed becomes an essential war product and cannot be considered in the category of any other product consumed by the public that might be a contributing factor toward general inflation. Inflation has already taken place in every other commodity except oil, whose price is three-fourths of 1926, the fixed standard year for commodities."

Further, the Bureau of Labor Statistics Index for Wholesale Prices shows that, in 1939, oil was 52.2, while other commodities were 77.1; in 1942, oil was 59.8 while other commodities were 98.8. In other words, the prices of other commodities were not only 48 percent higher in 1939, but, to the end of 1942, had risen 28 percent while oil had risen only 14 percent.

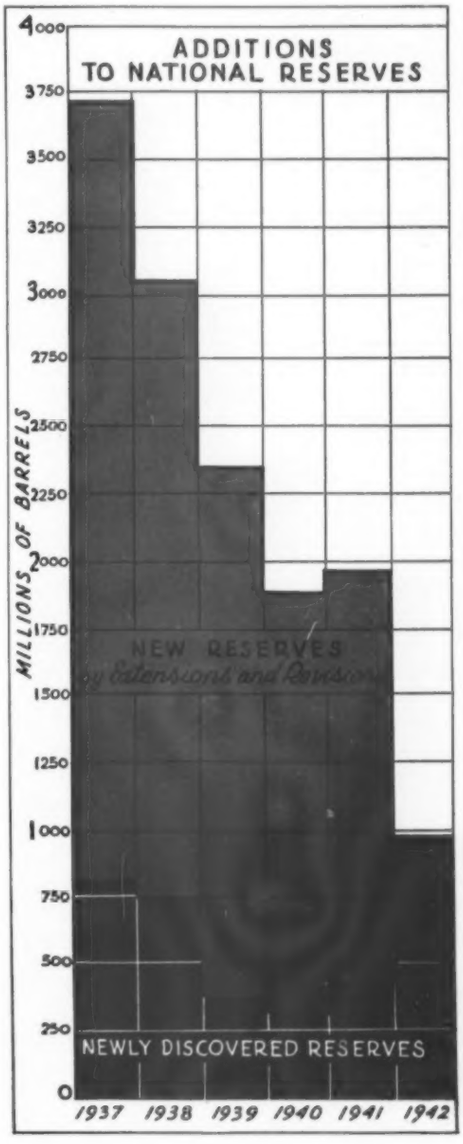
The OPA has just announced that present prices for all commodities are "only 39 percent above September 1939"; the oil industry wishes the price for crude oil was.

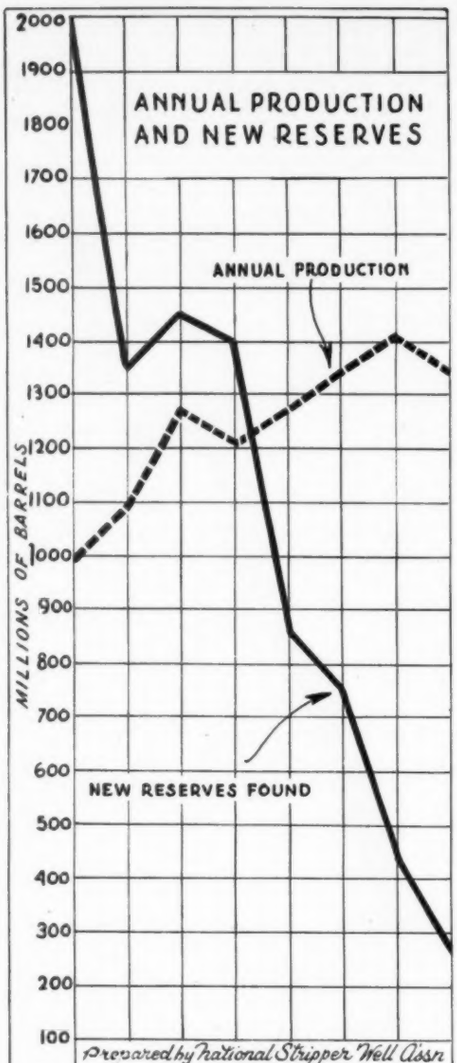
The Secretary of Agriculture has just announced an increase in the price of milk "to stimulate increased production."

The OPA has frequently raised prices for manufacturers in various industries. Just recently OPA raised the prices the government is paying to Chrysler Corporation for its marine engines—engines to be run by oil, while oil production is being curtailed by the fixed price ceiling of OPA.

OPA recently raised the price of anthracite coal 50 cents per ton—and coal is used in large volumes by the consumers while oil is used chiefly by the government, or on the government's industrial business. Coincidentally, this price increase immediately preceded John L. Lewis' demand for 50 cents more per day union dues—an added $6,000,000 per year, which, through the check-off, is merely added by the coal operators to the price of coal. Of course, the additional 50 cents per ton was ample to cover the financial donation to Lewis.

The recent ruling of the Office of Economic Stabilization decreeing a 48-hour week materially adds to inflation without increasing production in the principal industries whose equipment is already operating at a maximum. For those who worked a 40-hour week—and that was characteristic of many operations in the oil industry—eight hours additional, at time-and-a-half, produces a 30 percent increase in pay for already swollen pay envelopes and accelerates costly inflation.





So many other activities of the government result in price increases which directly produce added inflation that it cannot be accurately reported that indisposition to approve price increases prevents the OPA from increasing the price of petroleum and its products, which would have a negligible effect, if any, on inflation.

Opponents state that a price increase for crude would raise the price which necessary users would pay. Assuming that a price increase, recommended by some producers, of 50 cents per barrel resulted, the necessary increase in the prices of refined products would be very small—1¼ cents per gallon. No necessary user of petroleum products is going to believe that 1¼ cents a gallon is even a "price increase" compared with the price increases which the OPA has allowed on other commodities. Besides, 1¼ per gallon on four gallons—or less—per week would approximate five cents per week—an inconsiderable sum these days of multitudinous billions of dollars.

Opponents claim that a crude price increase would raise the price of refined products to the government. The government purchases, directly or indirectly, most of the petroleum products—directly for the equipment of the armed services, or indirectly for equipment manufacturers, or their employees.

The opponents of a price increase are the proponents of the "subsidy" idea. They fail to realize that in either case the government pays for the increased oil production—by the subsidy, in an unsound, political manner, universally condemned, or by a price increase, in the normal usual American manner, universally approved by government and used by the government in every industry—except the oil industry.

Thirty-thousand wells—the number drilled in 1941—costing $25,000 each—a fair average—would total $750,000,000 for governmental subsidies for drilling. $750,000,000 is 50 cents per barrel on 1,500,000,000 barrels of production slightly more than our 1942 production. The financial cost would be the same, but with subsidies the nation would get dry-holes, with a price increase the government would get oil.

Fifty cents per barrel on 1,500,000,000 barrels is $750,000,000, which is less than 7/10 of one percent (0.007) of our 1943 war budget, totalling $109,000,000,000, recently recommended by the President. Should OPA—or anyone—try to save 7/10 of one percent of our budget and run the very grave risk of wasting the remaining 99.3 percent of our war budget, and losing the war because of inadequate supplies of oil?

Remember, $750,000,000 is less than 2½ days' cost of this war to our country! Even if the extra cost to obtain adequate supplies of oil was seven percent, or even 70 percent to win this war, it would be well worth the cost.

The philosophy of purchasing supplies in wartime lays less emphasis on "How much does it cost?" and more on "Can we get it?" Oil is necessary to wage war; it is absolutely essential to have oil to win the war. As Woodrow Wilson once remarked, "It costs much to win a war; it costs much more to lose it." Lacking adequate supplies of oil would cause our country to lose this war.

Opponents claim that a general price increase for crude will benefit those producers who carry on infrequent wildcatting operations. That is true, and as they are enabled to produce more oil at a slight profit, they will try to produce still more oil at a profit; the natural sequence is increased wildcatting operations by all producers. That is the primary purpose of a price increase for crude—to obtain increased supplies of oil. History shows that the volume of drilling increased as the price of crude oil rose, and it slumped when crude price fell. Producers in the oil business want more oil; they will make extra effort to obtain it, if they can do so without a loss of their present business. An increase in crude price is necessary to urge all producers to produce all oil possible.

The maintenance of stripper wells and the retention of properties for development by secondary recovery require additional income. Automatically, a price increase will keep these wells alive; the extent of their activity depends on the amount of the price increase. Fifty cents per barrel increase in crude would greatly reduce the abandonment of stripper wells, because most of them could become profitable; secondary recovery costs would require perhaps 75 cents per barrel increase in some areas. These are developments of the future.

The fact is that OPA knows from its own experience that a price increase benefits production. The OPA authorized a price increase for Pennsylvania Grade crude oil effective March 24, 1942. The Pennsylvania producers had specified that the then declining rate of production would be changed to an increasing rate, if the price increase was allowed. OPA thereupon approved the request. Since then the production has mounted to 80,000 barrels per day and has remained there. The price increase accomplished its purpose; it increased oil production.

The entire question of a price increase simmers down to the question "How much oil does the government want produced?" If the government wants 100 percent of the oil it is possible to produce now and to reserve for future use, then the price should be set accordingly. If it wants less, then set the price less. At present, the price ceiling is paying for less than 50 percent of the oil, according to the Tariff Commission's report.

While it is uneconomic to determine the selling price of any product by its cost, in the ordinary free competitive market, in these days of controlled economy, where selling price and basic costs are fixed by the government, some relation must exist between the component costs and the selling price, or continued losses and liquidation would result.

The Tariff Commission report suggests a basis for determining a selling price for crude oil which would eliminate the inequities of a blanket price increase, and, while not achieving perfection, would allow reasonable increases of varying amounts to correct some present injustices.

Suppose that it was intended to provide a price basis which would pay for 95 percent of the oil, and allow a 10 percent margin on this set cost, which, after taxes, might approximate, perhaps a five percent net profit on sales, some tabulation such as the accompanying might result: (These data are for January 1939 to September 1941, and should be corrected accordingly for 1943 differences; they represent only the main geographical divisions listed in the report, others might well be used).

TABLE I

Area	Report's Cost at which 95% oil is produced	Plus 10% margin	Required Selling Price	Price Sept. 1941	Deficiency on Basis of Comm. Report
California	$1.17	0.12	$1.29	$0.99	$0.30
Rocky Mountain	0.96	0.10	1.06	0.89	0.17
Mid-Continent Gulf:					
Texas	1.28	0.13	1.41	1.10	0.31
Okla.-Kans.-La.	1.44	0.14	1.58	1.13	0.45
Arkansas	1.15	0.12	1.27	0.91	0.36
New Mexico	1.08	0.11	0.19	0.92	0.27
Mississippi	.70	0.70	0.77	0.83	—0.06[3]
Illinois	1.10	0.11	1.21	1.26	—0.05[3]
Eastern					
Mich.-Ind.-Ky.	1.80	0.18	1.98	1.28	0.70
Ohio-W. Va.-Penna.-N. Y.	2.86	0.29	3.15	2.40	0.75

Note 1—Louisiana and Arkansas—used data from Tariff Commission report showing costs at which 90 percent of oil is produced.

Note 2—Mississippi and Illinois—costs have materially increased since September 1941, greatly altering profitability.

Note 3—Mississippi and Illinois—Market price, as of September 1941, was in excess of production cost of 95 percent of oil plus 10 percent margin on cost.

Note 4—Pennsylvania Grade—Price advanced $0.25, subsequent to Sept. 1941.

Note 5—According to Tariff Commission report, production costs have increased 10 percent and production volume decreased 6 percent from September 1941 to June, 1942. Cost increases have been still greater since June 1942.

Note 6—A weighted average of production—price increases for the entire United States shows a general price increase requirement, according to above data, equal to $0.356 per barrel—a total of $493,000,000, based on 1942 production.

These calculations are merely a starting-point; they are not intended as the final figures, because they are historic and inaccurate at present, and need adjustment for present war conditions, and for changes which have occurred, particularly in Illinois, since that time. But they do present a basis for study and thinking.

What are the facts about this petroleum situation? From governmental, and other reliable sources, are presented the following:

1. The average demand for crude oil during 1942 was 4,150,000 barrels per day. The production averaged 3,800,000 barrels per day; a shortage of 250,000 barrels per day. Our stocks of crude petroleum and its refined products declined in 1942 by over 75,000,000 barrels.

2. In 1941, the industry drilled 30,000 wells; in 1942, only 18,000 wells. Wtih an increased demand for petroleum for war purposes, 12,000 fewer wells were drilled.

In 1943, it is proposed that a further reduction of 2,000 wells be suffered, and that only 16,000 wells be drilled—4,500 "wildcats" and 11,500 development wells—equal to one-half the number in our last pre-war year—not twice the number, mind you, but one-half.

3. New "wildcat" wells now contain only about one-quarter as much reserve oil as wildcats drilled three years ago. Examine this table:

Years	Average Number Wildcats Completed	Average Volume New Reserves per well—bbl.
1936-1938	2263	806,000
1939-1941	2963	216,000
Difference	700	590,000
% 1936-38 Period	30%	73%

Clearly, "the law of diminishing returns" has set in in the oil industry's exploration work, for each wildcat well now adds to reserves only about one-quarter or 27 percent as much oil as former wildcats. That means that we must drill not one-half (½) as many wells as formerly, as is proposed for 1943, but four times as many wells to maintain our reserves at a constant level—without even considering any excess demands by war.

Our primary task is to get oil. To measure our success, we should count not the number of wells drilled, but the number of barrels of oil obtained. We should change our requests for steel, so that they are based not on "tons of steel" but on "barrels of oil obtained to maintain our reserves."

4. Since 1938, we have taken from our underground reserves (by our annual production of oil from existing wells) about twice the amount each year which we have added to our reserves by our new discoveries of wildcat wells, i.e. our withdrawals from reserves have been twice our additions to reserves, for each year since 1938.

To maintain our present reserves of 20,000,000,000 barrels, in the face of our present annual demand for 1,400,000,000 barrels (which will be increased materially by war demands), considering that each wildcat well would add only 216,000 barrels to our reserves, we should drill, as a bare minimum, 7,000 wildcat wells—not 4,500 wildcat wells, a mere 60 percent of our needs.

Obviously the point is close at hand, where the utilization of steel for other purposes than the more vital purpose of obtaining oil, and thereby providing only 60 percent of the necessary oil reserves, will result in our ships, planes and tanks lacking adequate supplies of fuel and lubricants, and our military operations being curtailed through lack of oil.

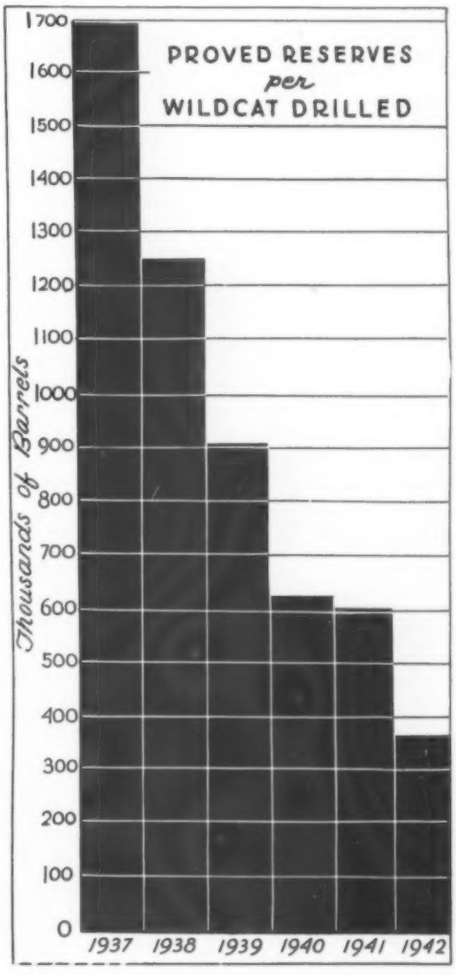
5. Reserves of 20 billion barrels, compared with annual production demands of 1.4 billion barrels, would seem to indicate a supply ample to last 14 years. Such is not the case. These wells are now producing at their maximum. Any attempt to increase production beyond their maximum, would undoubtedly seriously jeopardize the recoverability of the remaining oil. Such present forced production would reduce by perhaps one-third the total oil available when scientifically produced at the optimum rate.

Reserves of 20 billion barrels are available, but some of that oil is unobtainable for 30 to 50 years more.

6. From 1934, the number of new oil fields has increased but the barrels of oil as reserves ultimately obtainable, per field, has decreased from 20 million barrels per field in 1934 to 1.2 million barrels per field in 1941.

In 1937 and 1938, the fields averaged 12 million barrels of reserves; it would require 125 fields per year of 12 million barrels each to keep our reserves constant, in the face of our production of 1,400 million barrels per year from these present reserves.

Few fields discovered in 1942 will ultimately yield even 10 million barrels; most of them will equal less than half that amount.



7. Since reserves are available only over a period of years the problem of keeping current production constant is a particularly difficult job, for only a small percentage of the total oil recoverable from new wells is available in the first year of operation.

The 11,500 development wells will not add to our known reserves, but will continuously draw on these reserves in order to provide increased production for war purposes; they will accelerate the drafts on our dwindling reserves and speed the day of scarcity of our oil. The production from our present wells would be, on the basis of 1941 production equalling 100 percent:

1941	100%
1942	99%
1943	85%
1944	76%
1945	65%

To keep our present production at its present volume, without considering any increase for war demands, requires the following additions:

1943	600,000 bbls. per day	216,000,000 bbls. per year
1944	960,000 bbls. per day	346,000,000 bbls. per year
1945	1,400,000 bbls. per day	504,000,000 bbls. per year

8. The foregoing data refer to the problem of obtaining oil to satisfy national consumption only, without any increases due to war demand. Consumption in 1942 exceeded 4,150,000 barrels per day. Some government officials estimate that, during the next year, the increased demands for petroleum products *for war purposes alone will exceed 1,000,000 barrels per day.*

Such huge war demand could be satisfied only by severe curtailment of our civilian needs, which before the war exceeded 3,500,000 barrels per day, and so far have not been reduced by over 30 percent. Total needs for both military and civilian purposes could well exceed 4,500,000 barrels per day—a total of over 1,640,000,000 barrels per year.

9. Approximately 250 geological crews with seismographs and other scientific devices, were utilized last year by oil companies at a total cost of almost $20,000,000 trying to locate new oil fields in this country. Such intensive search produced very few new fields—all of them small.

Indications are that future additions to oil supplies will be found largely in stratigraphic traps; their location too frequently is the product of "hit or miss" drilling operations, as exemplified by several such fields, and not the result solely of scientific exploration.

10. During the height of the last war—in 1918—the demand for oil for all war purposes of the Allies and for civilian demands was approximately 1,000,000 bbl. per day or just about equal to the current production. By next year, military demands and reduced civilian needs may conservatively exceed 4,500,000 barrels per day. Today's production is 3,800,000 barrels per day. Since 1918, our demand has increased 4½ times, our production has multiplied less than four times. We simply must get more oil.

The price of Mid-Continent crude in April, 1917, when the war started was $1.70 per barrel; it was raised to $2.25 by April, 1918, and remained there during the war. So successfully did the American oil industry respond in the last war that a British statesman rejoiced, "The Allies floated to victory on a sea of oil." Price incentives were offered; the oil was obtained.

Let us look at the materials aspect of this picture. Steel is very precious; it must be apportioned to those uses which are most productive of good means to assure a speedy victory. No one use can demand all the steel, or even a disproportionate amount of it; conversely, no essential use should be denied below the level where national safely may be impaired. That problem faces the dispensers of steel to the oil industry.

Seven thousand wildcat wells each year are necessary to maintain our reserves balanced against our demands; less than 7,000 wells may be unsafe. How far dare the nation go in not drilling wildcat wells? Four thousand five hundred wildcat wells can hardly be considered adequate.

The lack of steel for new wells, however, compels the oil industry to work harder to retain its present producing wells and forces a recognition of the inter-relationship between supplies of steel and price of crude oil. The unavailability of the necessary quantities of steel to assure adequate new oil production forces the decision to increase the price for crude oil to save the oil in "stripper" wells which otherwise may be prematurely abandoned and forever lost to recovery.

If the nation is so short of steel that it cannot drill enough new wells to bring enough new oil into the industry, then it seems the height of wisdom to spend some few of this country's extra dollars to retain in the industry the old oil which it already has in "stripper" wells, and the oil available by secondary recovery methods. If we are "short" on steel, then we must spend some of our "long" dollars.

When sufficient steel is not available to drill the minimum number of wells absolutely needed to supply oil for war, then a price rise becomes absolutely mandatory to retain in usable form several billion barrels of precious oil equal to four years' present total production—which we now have available — available only if we raise the price to cover the cost of obtaining it.

But we cannot delay any longer, no matter what our course of action. About two years elapse between a field's discovery well and the availability of volumes of production; about two years elapse between the start of secondary recovery activities and the obtaining of satisfactory volumes of oil. Drilling additional wildcats and raising the price of crude oil—both must start now, if we want additional oil by 1945.

Any hesitancy to allocate steel for the production of oil should now diminish; any hesitancy to offer an increased price for crude oil as an incentive for its increased productions should now vanish. The restraining considerations caused by the complex relation of this price increase to the refining and marketing branches and to the entire civilian economy have now been swept away by, and sacrificed to, the more important considerations of war and essential victory.

Almost every industry has received a price increase to "stimulate increased production," except the oil industry. The price of crude oil should certainly be raised to the point where the price paid covers the expenses of obtaining the oil, and yields a small reasonable profit to the producers—the same incentives as the same government officials offer to every other manufacturer of war supplies to obtain the same result—increased production to assure adequate supplies to guarantee victory.

Recently the producers of solid fuel—coal—went on strike to obtain increased wages of $2.00 per day, although their contract did not expire for several more months. Regardless of how justifiable such a strike was on its merits, it received universal public condemnation, because it was called during wartime.

The oil producers of this country are staunchly patriotic; they have proven it, and are daily continuing to prove it. Everyone knows that they would never strike against their government. How much longer they can continue to operate at a loss Heaven only knows. They will continue, however, to produce oil as best they can for their government, and for the benefit and salvation of the men in the armed services.

From the viewpoint of national interest the problem presented by the existing oil situation is not one of enabling oil producers to operate at a profit, or even of keeping the small producers alive, except as such action is necessary to insure a steady flow and dependable supply of products imperatively demanded in order to conduct the war to a successful finish and to win a decisive victory for the United Nations in the cause to which millions of men in many lands have pledged their lives, their fortunes and their sacred honor. It is in this light that the subject should be dealt with by statesmanlike action along lines of proved effectiveness to assure a continuing supply of the one commodity most essential to winning the war and maintaining the peace to follow.

Making a connection. Here the Kelley is being made up onto drill pipe. The Kelley is the square shank of steel which is connected to the rotary table for turning the drill pipe. Shortage of Manpower in the essential oil industry is a serious problem.

MANPOWER PROBLEM of the Oil Industry

Report of Special Committee Urges Management to Impress Upon Employees the Essential Nature of Their Service in Winning the War.

LOSS OF MANPOWER to the military services and to munitions plants has been felt in all branches of the oil industry but has been most serious among engineers, chemists, research workers and other specialists — those who are most needed and most difficult to replace. This in substance is the statement of conditions reported by oil companies generally and confirmed by the report of a special committee on manpower consisting of John M. Lovejoy, chairman, Sidney Belither, J. W. Carnes, N. C. McGowen and J. Howard Pew, with J. L. Dwyer, secretary, which was submitted to the February meeting of the Petroleum Industry War Council.

While recognizing that it was the duty and expectation of the oil industry to contribute its fair share of men to the armed forces the committee added the reminder that "oil workers are war workers" and pointed out that their services in helping to produce, refine and transport oil are just as necessary to the successful prosecution of the war as are the labors of those who are employed in the making of armament. On this point the committee's admonition was supported by a joint statement issued by Petroleum Administrator Ickes and Manpower Commissioner McNutt in which they said, "Oil and natural gas are vital to this war and it does not help to win the war for men who have long been trained and skilled in this industry to leave their present jobs. While planes, tanks and ships fight the battles, they cannot fight without oil to fuel them." They urged that oil industry workers should not quit their jobs through the mistaken idea that other kinds of work were more necessary.

In the report of the Manpower Committee it was stated that the loss of men had not impaired the ability of the oil industry to meet the demands made upon it but that difficulty was being experienced in carrying on certain of its activities. "Service units," said the committee, "such as drilling contractors, geophysical companies, well acidizing and core analysis organizations, have suffered serious depletion of personnel. Technical men in all branches of the industry have been drawn upon most heavily and are the most difficult to replace."

Certain specific suggestions for meeting unavoidable drains upon working staffs and preventing unnecessary shifts in employment were addressed to oil industry management by the committee. These may be summarized as follows:

1. Establishment of a company employment pool.
2. Employment of women and older men, with examples of the types of oil-company jobs that women can fill.
3. Investigate the possibility of increasing the use of non-white employees.
4. Cease retiring employees who still are able to perform a job.
5. Search lists of former employees over 38 now in the armed forces, who may wish to return to your company under the provisions of recent regulations.
6. Do not attempt to persuade local draft boards to defer every employee. Use Form 42-A for key men and those in critical jobs only.
7. Encourage present employees to find new employees among relatives and friends.
8. Look for new employees among wives of young married men going into service.
9. Relax any rules that women who marry must resign.
10. Relax physical requirements to employ physically-handicapped people for certain jobs.
11. Use the Manning Tables developed by the War Manpower Commission.
12. Exhaust all possibilities of upgrading, job-break-down, and in-plant training.
13. Use every effort to obtain deferrment for professional personnel, but do not overlook the possibility of women for some jobs such as laboratory assistants.
14. Smaller companies and individual operators should adopt similar policies modified to fit their size, planning in advance for the replacement of employees.

The committee recommended that oil companies use every possible method of informing employees of the essential nature of their work in the petroleum industry, through employee meetings, company magazines, special booklets, movies, local advertising, posters, and other means.

"Petroleum is the very life blood of mechanized war," the report emphasized. "Airplanes, tanks, jeeps, submarines, and battleships are fueled and lubricated with petroleum. Add butadiene for rubber, toluene for explosives, asphalt for runways, and the underlying importance of petroleum in the prosecution of the war needs no further presentation."

In concluding the letter transmitting its report the committee said:

"This is a job to be done by management. We have a great opportunity for service to the nation, and a great responsibility. Let us tell our employees that they are doing a real war job. Let us approach the manpower problem intelligently, and solve it within the industry."

LOSS OF SKILLED WORKERS

Presents Drilling Industry Problem

By BRAD MILLS

Aside from Selective Service Draft on Manpower the Curtailment of Activities During 1942 Caused Heavy Exodus to Other Industries —Settled Drilling Policy Needed.

Brad Mills, Executive Secretary, American Association of Oilwell Drilling Contractors.

ACTIVITY in the drilling branch of the oil industry fluctuates over a wider range than that in other branches of the industry. It may be strongly affected by extremes having only nominal influences on the production, refining or marketing divisions. This erratic tendency is caused by supply and demand, economic conditions, national emergencies, and numerous popular conceptions or policies that may or may not have a real foundation.

For more than 60 years the oil industry has tried to adjust itself to the national economy and to conditions existing within its own realm. During one cycle of a few years the hysteria of exhaustion has prevailed, during which every operator has done everything in his power to develop oil reserves to meet an anticipated shortage. During a subsequent overproduction cycle the pendulum has swung far in the other direction to bring about sharply reduced drilling operations. Thus it has been a feast or a famine for a half century, giving the drilling branch a very jerky journey to say the least.

The need for accelerating the drilling rate can come about quickly. Fortunately, Pearl Harbor found this country's petroleum reserves adequate for the moment, but it was obvious that only through continuation of a well-rounded drilling program could necessary reserves be maintained. The urgent need for steel in other vital industries has influenced the drilling industry to accept a very modest program, one that may soon precipitate increased operations to meet actual day-to-day petroleum requirements.

Obviously, it would be much better if a uniform drilling program could be carried out from year to year, but a sharp fluctuation in demands, demoralization of transportation facilities and a shortage of certain basic materials have combined to change the entire drilling picture since Pearl Harbor.

One of the most serious problems around the average drilling well is the lack of trained men. Due to the curtailment of drilling activities during 1942, a large percentage of the personnel in this branch of the oil industry has sought employment in ship yards, aircraft plants and other defense projects, to say nothing of heavy loss through selective service. Drillers, firemen and floormen have had sufficient mechanical training to enable them to fit readily into almost any construction industry, and they are regarded as excellent workmen or semi-technicians wherever they are employed. This exodus has confronted the drilling industry with a serious labor problem, even when operations are far below normal. If and when it is necessary to increase the volume of drilling to provide a greater production of oil for war industries and domestic consumption, there may be an acute shortage of trained workmen to accomplish the purpose.

The need for maintenance of efficient oil well drilling crews is recognized by all vital United States government agencies familiar with petroleum requirements. It is obvious that only retention of the greater number of skilled employees now engaged in the oil well drilling industry may a necessary development program be assured. The oil well drilling industry already has lost a high percentage of its skilled employees during the past 18 months, this loss having been occasioned by the combination of circumstances outlined in the preceding paragraph.

Drilling operations have always fluctuated from month to month, depending on numerous factors. These booms and shut-downs have been wasteful in many ways, since they result in overwork of available manpower and equipment during the boom periods, and in idleness during the slack periods.

The lack of uniformity among selective service boards in oil producing areas also has resulted in some confusion regarding deferment of certain skilled workmen and key men in the oil well drilling industry. Generally these boards have deferred the necessary employees without question, but in several instances they have not fully recognized the oil well industry as one vital to the war effort.

A training period of several years is required before a man can become a driller. Other skilled workmen around the derrick require a training period of from one to four years. A small percentage of "green" or unskilled men may be used in the drilling industry, but any individual drilling crew must be made up of thoroughly experienced men. In a 4- or 5-man crew it may be possible to run fairly efficiently with one unskilled man. Two unskilled men in any crew may cause serious trouble, while three men of this type virtually would paralyze operations.

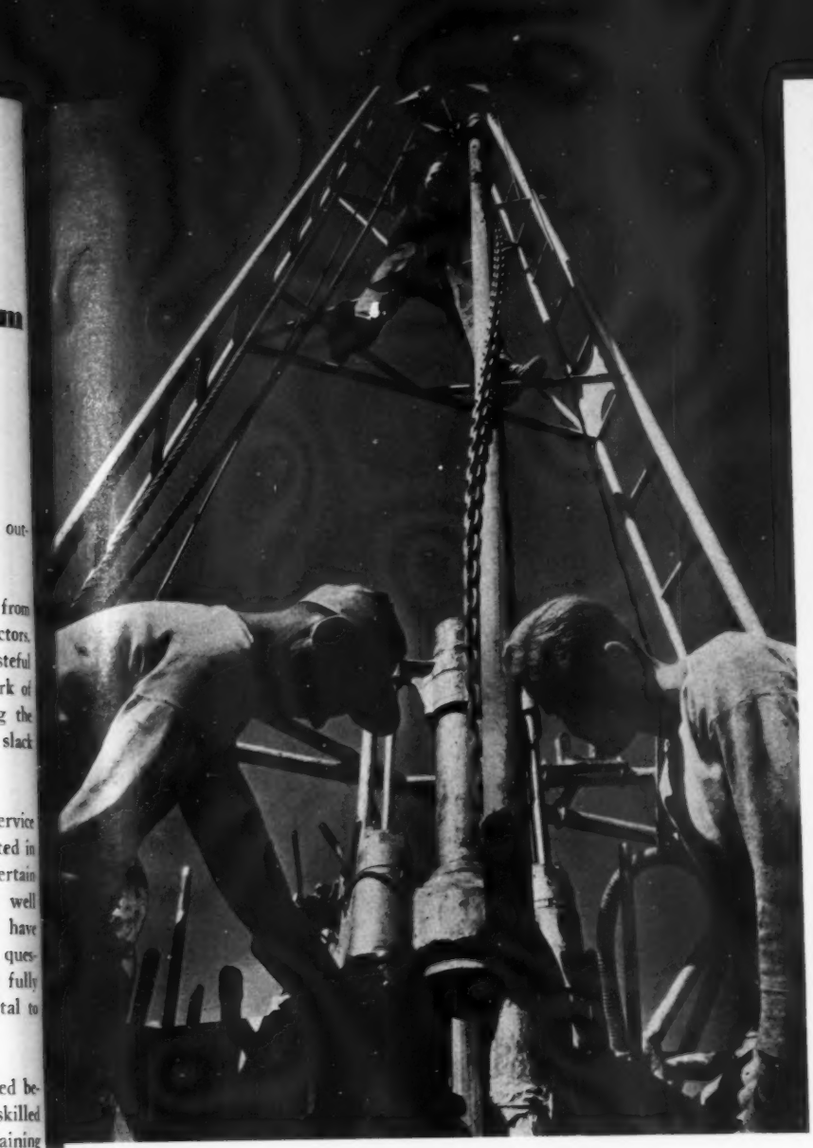
The War Manpower Commission has stated that in the case of former drilling employees who are now working in ship yards, etc., it is permissible to invite these employees back into the drilling industry. The oil well drilling crewman who changes to another vital industry has no special obligation to this new work, and will be permitted to return to his former job provided by doing so he may render an equal or greater service to the war effort.

Top left: Setting drill pipe is a job for specialists.

Top right: Tightening a stand of tubing takes muscle skillfully applied. Photo by Clarence Block for Axelson Manufacturing Co.

Bottom left: Speed in pulling drill pipe comes only from long experience.

Bottom right: Derrick man goes into action protected by safety belt. Handling a giant hook like this is no task for a greenhorn.



The several thousand skilled workmen who have drifted from the drilling industry into other vital industries are scattered all over the United States, and would be difficult to contact. Because of this it is very important that the industry retain a high percentage of its present skilled workmen, while training as many men as possible to replace those lost.

The shortage of suitable manpower in other industries makes it very difficult to obtain unskilled workmen for drilling crews. This type of work requires strong and intelligent men, and misfits from other industries cannot be used under any circumstances. Formerly the greatest percentage of men in drilling crews came from farms, but this source of supply has been virtually exhausted.

The experienced driller and helper take pride in the equipment used, while the green or inexperienced helper assumes an indifferent attitude toward materials now so vitally needed. The efficiency and morale of a drilling crew rises or falls in proportion to the number of new men on it.

Occupational Bulletin No. 15, issued August 5, 1942, by the Selective Service System, recognizes the drilling industry as one essential to the support of the war effort. However, this bulletin does not recognize deferment for ordinary "helpers" or "roughnecks." This omission is due either to an oversight or to the assumption that these men are not truly skilled. Although they may not be "skilled" in a technical sense, they are trained men whose replacement by inexperienced men results in inefficiency, breakage of machinery, accidents to persons and property, and an overall waste. The so-called "roughnecks" are skilled rotary floormen who are almost as important to efficient drilling operations as the driller himself. It is generally held in all drilling areas that these rotary floormen should be listed under critical occupations listed in Occupational Bulletin No. 15.

It is believed that a definite and positive reassurance from an official source to the effect that employees engaged in the oil business are discharging their patriotic duty, and that it is their individual duty to perform those functions for which they are trained, rather than change from job to job, probably would have a very stabilizing moral effect. Undoubtedly effective rules should be prescribed to prevent needless shifting from job to job within the field of industry merely because of temporary and negligible differences in working conditions. Eventually such a stabilization plan will be applied to all vital industries, if each industry is to function most effectively.

The drilling industry normally employs more than 50,000 skilled workmen, but this number has been reduced so radically it has been very difficult to start new drilling operations in most of the producing areas. Should the necessity arise for increasing drilling operations materially over those of last year, the lack of skilled workmen undoubtedly would constitute a serious problem, which must be met promptly.

Available drilling equipment in the United States at the outbreak of the present war was adequate for carrying on normal drilling operations for some time, with the exception of repair stocks and adequate replacement items. With the government urging the conservation of vital materials of all kinds, it has been possible through the distribution and division of surplus equipment to carry on drilling operations with a minimum of new supplies. The service life of a drilling outfit is difficult to determine as a single unit, since many of the major items last several years and other items wear out in a short time. Frequent repairs and replacements naturally will be necessary to carry on drilling operations in any district.

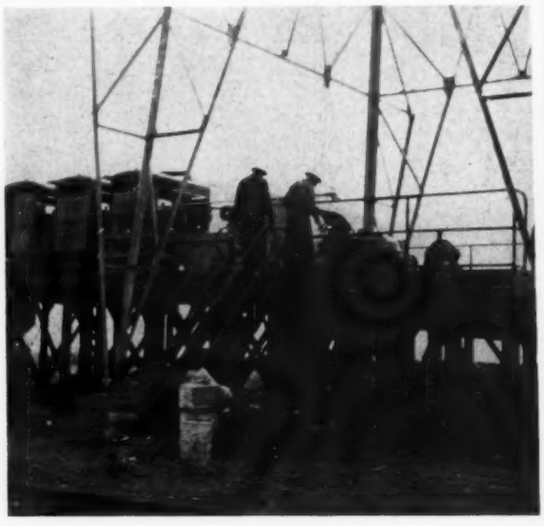
The drilling industry now is attempting to determine actual equipment and material requirements for drilling any specified number of wells needed to maintain adequate petroleum reserves. It is necessary that organizations actually drilling the wells, the proper Washington war agencies, and the equipment manufacturers coordinate their efforts toward making available these necessary materials. Unless actual requirements are anticipated considerably in advance of actual use, material shortages will seriously retard needed equipment. By fitting the manufacture of repair and replacement items exactly to drilling industry requirements, inventories may be reduced to a minimum without undue alarm. Assurance that the proper replacement items will be available when needed will have a beneficial effect on the industry as a whole.

The cost of a rotary drilling outfit ranges from $25,000 for a light rig to more than $200,000 for a heavy Diesel-electric rig. A heavy type steam drilling outfit costs about $125,000. Such high original costs make it imperative that the equipment be kept in good working order through constant replacements.

The war-time desire of the drilling industry is to conserve vital materials, while drilling enough wells to maintain adequate oil reserves and hold together drilling organizations.

It has been possible to use substitutes where the safety factor permitted, and a reduction in the use of scarce metals or alloys has taken place. Old equipment is being utilized everywhere and the service life of nearly every material has been lengthened.

The Petroleum Administration for War has called for the drilling of 4,500 wildcats, and 11,500 development wells this year. This can be accomplished satisfactorily if materials are made available as they are needed, or with a minimum delay. Only a limited number of large capital items will be required, but replacement items have become more vital than ever because of limited inventories and the tendency to obtain maximum service from machinery before making replacements or overhauling.



Drilling rig representing flexible and economical power combination — two engines handle ordinary drilling operations. All three are joined together for hoisting. Photo courtesy Unit Rig Company.

The transportation problem, as it affects the drilling industry, has been handled remarkably well by the Office of Defense Transportation, Office of Price Administration, Petroleum Administration for War and other War agencies. A year ago this phase of operations threatened to retard drilling work, but through the far-sighted policy of the ODT, OPA and PAW, the movement of both materials and men has been accomplished with a minimum loss in time. Drilling crews have pooled their own facilities, and by doing so have been able to obtain necessary gasoline and tires for carrying on essential work without interruption in time and efficiency.

The drilling industry definitely feels the effect of manpower shortage, the need for a more balanced material supply, and other shortcomings occasioned by the war, but it stands ready to do its part toward assuring this country of an adequate supply of petroleum products.

GEOCHEMISTRY'S PLACE in Future Exploration

IN THE October 1942 hearings before a Senate Subcommittee to "Encourage the discovery of oil and gas on the public domain," the final recommendations included geochemical prospecting with the following statement: "1. Make geophysical and geochemical surveys of the public domain and publish results of such surveys."

The United States was not the first government however to recognize geochemistry as an established means of increasing oil reserves. It is probable that the government of Peru, South America, has that distinction, having used commercial geochemistry for the same purpose for over a year.

Since the legal battles over patent rights are now over and most of those concerned have patents,

Photo above: Drilling a wildcat in South Texas following a survey.

While Too Much Was Claimed for and Expected of Geochemical Methods When First Introduced They Have a Well Defined Place Among Exploratory Tools.

By ROBERT O. SMITH*

*President, Chemical Oil Survey Co., Ft. Worth, Texas.

Prospecting crew working in submerged areas.

licenses, or nothing, it turns out that the Russians, during the Bolshevik era, were the first to actually employ geochemistry, at least experimentally, in prospecting for oil.

Their version of geochemistry arrived at the problem immediately. It was: (A) Most oil has gaseous hydrocarbons dissolved in it. The two lightest are methane and ethane. (B) Since gases have the property of ever expanding they must come to the surface soil mantle and then may be tested.

They finally elucidated the theory that the ratio of ethane to methane was important in their geochemical efforts. Chemically this conception was plausable and probably does have merit in Russia. In America this way of arriving at geochemistry has not proven out. This is perhaps due to the entirely different class of hydrocarbons which compose the two oils and any such relation probably does not mean the same here.

Although the Russians do state in their literature that some extensions were made to pools already known, it is not certain that they thought of geochemistry in terms of anything more than interesting experiments. In America geochemistry has had more difficult problems to surmount, due mostly to the fact that the hydrocarbons involved are of the less reactive families.

Two other factors have contributed to cause confusing results. One is the fact that certain strata cause concentrations of hydrocarbons of noncommercial proportions. Such fake oil accumulations are primarily caused by lime strata which are near source beds and do of course at times produce oil in commercial quantities.

The third cause of distress to geochemists is the "shifting of apparent structure with depth." Levorsen (Bull. A.A.P.G., 11, 671) is of the opinion that the shifting with depth is in the direction of the convergence of the strata. The reason geochemistry is affected by this shift is because the fracturing follows this shift from the structure to the surface formations. Formerly geochemistry was at the mercy of these difficulties. Modern improvements have contributed much in developing a more foolproof geochemistry.

The first difficulty, the chemistry, has been developed to a precision art. It is roughly estimated that at least $2,000,000 has been spent on various geochemical laboratories. Some for exhibition purposes have been marvelous exhibitions of modern chemical technology. It must be noted, however, that the cost of a laboratory in as new an art as geochemistry is not any reliable means of estimating the quality of the geochemical results obtained. Geochemistry is therefore still a highly skilled "art." For this reason there is a vast difference between the operating results of the various laboratories.

The second difficulty, non-producing lime showings, has been counteracted in practice by the discovery that it was possible to determine where the oil indications were originating from, whether a lime strata or a sand strata. All modern geochemical survey reports thus distinguish, on the maps supplied, the lime oil producing fields and also the oil fields producing from a sand. While mistakes are still made this development does correlate most of them in the "Favorable Lime oil zones." This has automatically raised the overall efficiency of geochemistry, from good geochemical laboratories, from a probable 30 percent efficiency to a much higher rate.

The third difficulty, the drift factor, has not so readily been solved. The knowledge of its existence, especially through non-conformities, has assisted greatly, however, in deterrence from the assumption that a favorable prospect is directly under the surface zone indicated by a geochemical survey. It is an interesting fact, in passing, that one of the two known probable ways of predicting depth of oil is bound up in this problem. It has been noticed many times in geochemical laboratories that some hydrocarbons originating in an oil accumulation come up more vertically than do others. By a process of trigonometry, therefore, once these problems are solved, the depth of the origin of the indications may be determined. Much data on this behavior are available on specific localities so that depth is calculated by charts prepared for that purpose.

There are some strange exceptions to the drift theory. In one prospect approximately 4,000 ft. deep in Stephens County, Texas, a 200-bbl. oil well was found directly underneath. It still produces after two years. No other well is near. Another such case is the Kennelworth well in Louisiana, where one well exists having drilled 11,500 ft. It was also drilled directly below the recommended area. A famous geochemical extreme in the other direction is the case of the production found at Leesville, Camp County, Texas where the production was found at 7,000 ft. over two miles from the center of the recommended zone although within the outer edge recommended. The picture was clear enough but drift had certainly played a prank. It is believed that diverging "ages" between oil pool and the surface is the greatest offending factor.

When chemical investigators began to discover many of our common inorganic chemicals a century ago some of them were sold to the public as remarkable cure-all medicines. These same chemicals are known today to have no particular value in curing anything. While these relatively elementary compounds were for the most part oversold and could not do what they were heralded to do, mostly from misapplication, yet the fact remains that some of our specific cures such as sulphopyridine for pneumonia, are a direct outgrowth of such gross misapplication. While at first oversold, in the long pull chemical medicinals have more than rewarded their adherents.

In this sense, geochemistry probably has been too much oversold for its own benefit. It seems that geochemistry made its appearance about the time when everyone was momentarily expecting some remarkable way to be developed of detecting oil directly from the surface of the ground with many thinking that geochemistry was the possible answer it quickly became oversold so that what merit it may have had was overshadowed by the disappointments it brought.

It is no particular secret however that geochemistry has fared better than first results appeared to indicate. It has had some notable successes and some flat failures. As an example, geochemistry verified and recommended two well known oil pools in the Illinois basin for an oil man. Yet subsequent drilling based on geochemistry where the man put his own money into the wells so unsold him that he is not now regarded as a customer.

Just how good must geochemistry be to be good? Perhaps a little chart we used to amuse our salesmen with will illustrate this paradox. The chart purported to tell what became of our customers as time went on. It goes like this. "100 oil men invest their savings in as many blocks, and we make the geochemical surveys. Ninety blocks are condemned. Their savings are lost. Ninety customers are lost. Ten blocks are recommended. Seven fail to produce. Their savings are lost. Seven more customers are lost. Three wells discover oil. Then men get rich, but spend the rest of their lives "drilling in." They don't need any more geochemical surveys. Three more customers are lost. Thus goes the whole 100 customers."

A company ordered a geochemical survey in West Texas. A well known oil field was found after geochemistry verified the zone. Because the outline did not coincide with the outline of the drilled-in field, although the discovery was in the zone recommended the company condemned geochemistry. Likewise, on a geochemical survey an operator drilled in two oil wells in Miller County, Ark. Because the third well was dry within the recommended zone geochemistry was condemned.

Perhaps the day is near when a field can be precisely outlined, but it is believed that the most important mission for geochemistry, while it is making these added developments in precision outlining, is the uncovering of the first oil—the discovery of new reserves which are now so greatly needed. It is not intended to say that everyone engaged in geochemistry is an expert in his line, nor yet that the most experienced geochemists have not greatly disappointed some of their customers; the fact remains that the best geochemical methods have not fared nearly as badly as some would have us believe. Small and inadequate surveys have cut heavily into the efficiency in some districts. Where adequate surveys have been made it is estimated that four wells have come in out of every 10 recommended. In Southern Louisiana, where the oil men are cognizant of the necessity of doing thorough geophysical surveys, it is definitely known that every other wildcat drilled on geochemical surveys is producing oil.

Below: John Jones prepared for military service by hunting for oil (note the augur in his hand) in the jungles of South Louisiana.

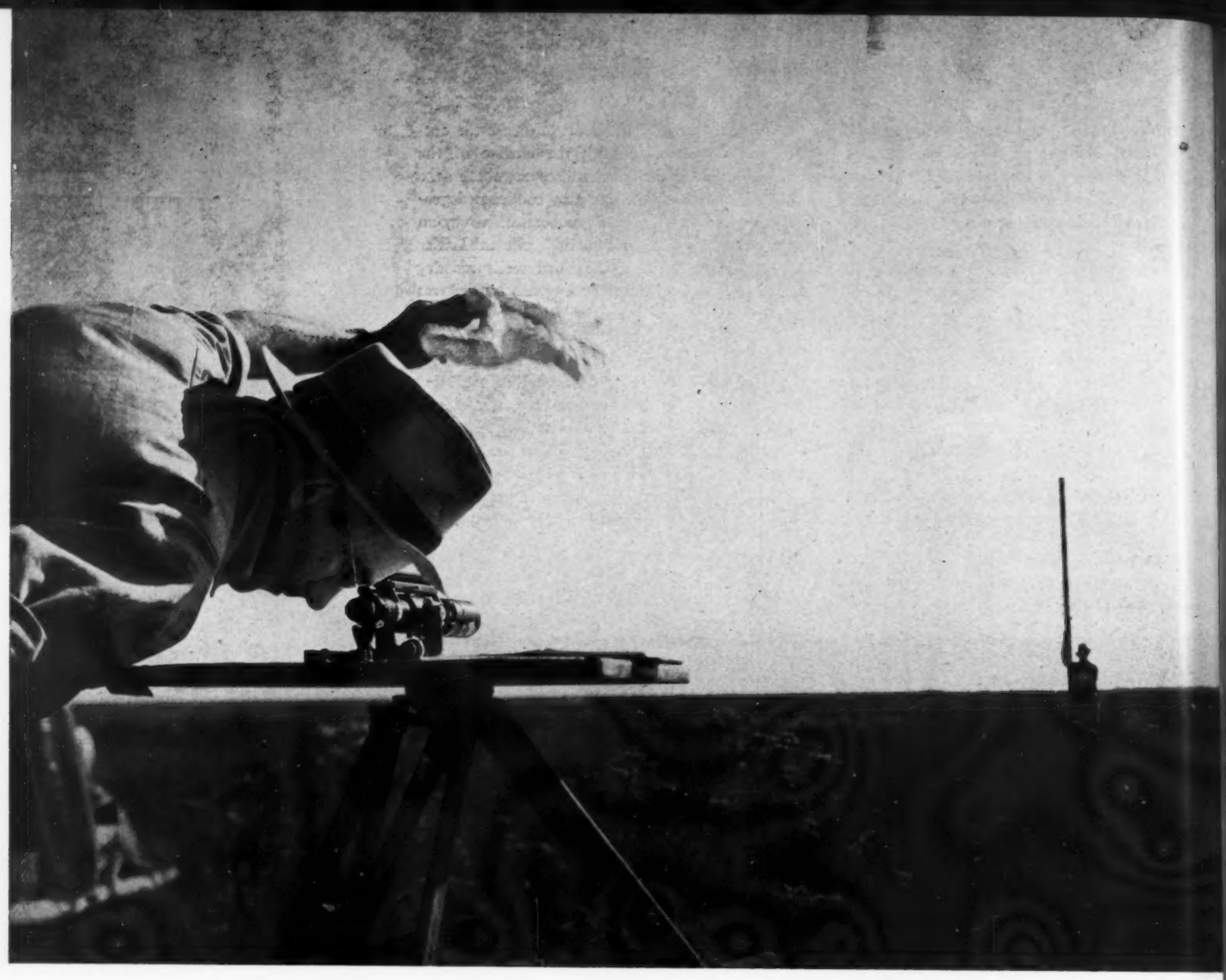
Below: Making a soil test.
Photo by Robert Yarnall Richie.

It is now beginning to be known that the "anticlinal theory" is essentially wrong when it comes to finding the probable location of most of the oil reserves. The anticlinal theory was and is very useful in determining where the oil would have been had it not been trapped before it got there. No doubt there is at least three times as much oil impounded in these stratigraphic traps as has been found on the anticlinal areas themselves. The difference however lies in the fact that the oil on a structure may be found if present, because structures and domes are relatively easily found by physical and geological means. While there are vastly more oil reserves in stratigraphic traps, they are difficult to find because there is no adequate physical means of determining their presence.

It is in finding these stratigraphic traps that geochemistry has a field of special usefulness. It was by the use of geochemistry in combination with geophysics and geology that the Santa Barbara oil field in Venezuela, South America, was found.

No doubt the future technique in the application of geochemistry will follow a pretty well defined plan. Geology correlates geophysics and geochemistry for the purpose of determining the structural relation of favorable hydrocarbon zones. This procedure correctly applied will bring to light many reserves now unknown.

(Continued on page 49)



Members of a field party engaged in a seismic survey. Photo by Robert Yarnall Richie

Accelerated Discovery Through Geophysics

Scarcity of Manpower and Materials Suggests Avoidance of Duplication

Closer Control and Pooling of Information to Meet Emergency Conditions

By L. I. FREEMAN

President, Heiland Exploration Co.

HISTORIANS should clearly state to the next generation a fallacy of thought that existed during World War II. A sample might read: "As late as 1943 most of the people of the United States were looking upon their 20 billion barrels of crude oil reserves as an enormous tank from which the total volume could be withdrawn by merely turning the spigot. They failed to realize a fundamental that only a fraction of this reserve was available during 1943, the most critical year of the war." The story will continue to call attention to reasons for such a condition. Perhaps some will say that too few realized almost too late, the alarming situation. Perhaps some bold person would say, only the abrupt ending of the war prevented a disaster.

As "oil-finders" geophysicists are directly concerned with attempts to increase our oil reserves. Mobilizing geophysical talent for new methods of finding oil is not the problem in this present emergency. Efforts along that avenue to greater discovery have been made continuously during the past ten years. Those capable of such research have been spurred on by those persons desirous of short cuts and less cost per barrel of new oil. This stimulus to direct discovery has led to exhaustive research in the field of science. It has not resulted in and cannot be expected to develop any quick and infallible method of reaching hidden stores of oil. It is believed today that our new oil finds are going to be located the hard way, by application of every conceivable method and knowledge to the areas in view. This is opinion only and subject to facts as we learn them in the year to come.

The purpose herein is to confine the picture to the geophysicist and his problems relative to accelerated discovery. It should be said at this time that geophysicists for twenty years have been devoting their entire efforts to this very problem. It has been in the past and will continue to be their daily work. Following the successful application of the methods that had demonstrated their usefulness twenty years ago, discoveries were made in rapid order. Many large structures were soon found. Dry holes per discovery were reduced. Soon, however, we ran out of the simple type structure. Today, we are looking at second and third class structures, even those with incomplete closure.

If we have few first-class prospects for drilling, then we must find more of the second or third class ones. This means more parties in the field, greater effort by each party. We immediately run into difficulties. While our various allocation boards have allotted us much in the way of materials, the amount is insufficient to the degree that we are unable to maintain in the field our normal complement of exploration parties. Added to this, our operating personnel is below minimum needs, due to a shift of technical men to Army and Navy work, either by voluntary or draft measures. Effective field work is further reduced by labor legislation and the 40-hour week. Many companies actually work only five days a week to satisfy labor laws. The only measure available then would seem to be a more efficient operation of what we have available, a more efficient execution, and a speeding up in testing what structures we already have to find in the near future. Included in the category of more efficient exploration would be the following:

1. Limit the field of operation of a particular exploratory geophysical unit to an area to which the type of equipment is best suited. Place in charge of operation of that unit men most experienced within the area. Confine the exploration of the area to that unit, to avoid the waste of time and money involved when as many as ten different companies explore the same area, each with its own crew and equipment. This aspect of competitive exploration can hardly be afforded in this present emergency.

2. Separation of districts or subsidiary companies in order that a state or district division may operate as such without all the delay and indecision arising from headquarters decision even in small matters. In many of our large oil companies with active subsidiaries, the time lost between discovery of structure and the ultimate testing of drilling often consumes six months to a year. District offices, with their complement of geological, land and geophysical departments are in most cases fully competent to appraise, assemble leases and conduct exploratory drilling. If such a company having a district personnel is not willing to test structures as found by direct supervision of the district offices, then that company should not maintain such a district. More decision and responsibility then for the district.

3. Pooling of information within each area. Geophysicists could be relied upon to handle such information in an ethical manner so that no single company or individual is hurt. This information could be handled in quite the same manner as scout check meetings. The establishment of district boards of geophysicists for active consultation when problems of correlation exist in critical spots. This might save many dry holes drilled at great expense. Materials used in unnecessary dry holes cannot be spared out of our stock of steel. Many dry holes have been drilled in the past which could have been prevented by active collaboration of the district geophysicists.

The above suggestions involve practices never entertained by companies engaged in oil production. They mean a radical change in policy. Company policy would have to be changed to accommodate even one suggestion. They unquestionably would meet with a great deal of opposition. Their adoption, however, might be the means to accelerated discovery.

As geophysicists we are ready and willing to make any adjustment. The above suggestions involve nothing too radically different from our daily chore. We exchange academic information continually. We have no great selfish interests. We have one common purpose, the locating of new oil reserves. Where we are sent, what we are to do, have always been decided by a company policy. Perhaps today that "company policy" is to find more oil, regardless of where or how, and the end will justify any means.

If the situation is as serious as some believe, then exploration will have to go "all out." The Office of Petroleum Administration for War may be in position to initiate means for broadened cooperation. Whatever the incentive to increased exploration, whether by price increase or other means, something must be done. The time is late even now.

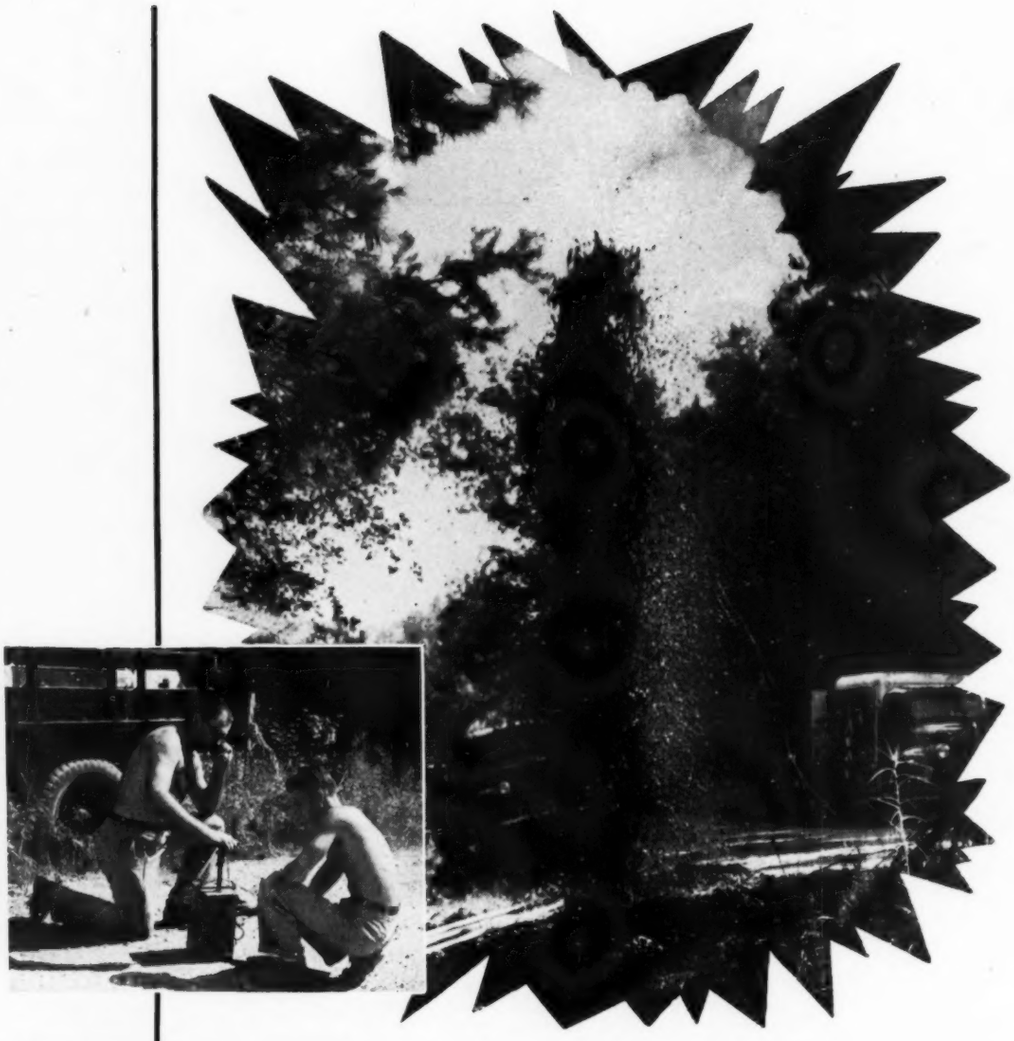
Geochemistry's Place in Future Exploration

(Continued from page 47)

So far as the utility of geochemistry is concerned it is reasonable to expect the following developments: (1) It will be employed more extensively as an exploratory tool for new prospects; (2) as an outlining agent, as its efficiency becomes greater along this line (3) and as a means of determining favorable and desirable strata for drilling with the discarding of unfavorable lime zones.

With the increasing scarcity of preferred structures that the oil industry must follow one of two courses. It must either direct its exploration operations to virgin districts or find the stratigraphic trap reserves. In the one case the geology is mostly unknown; in the other no adequate physical means is at ready disposal to detect such fields. In both cases it will be found that geochemistry correctly applied, admirably fills a most difficult place in exploration for new oil reserves.

Preparing a shot in course of geophysical survey. Photo by Robert Yarnall Richie for Seismograph Service Corp.



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HOUSTON, TEXAS

Foreign Oil Legion

EMILE E. SOUBRY has been appointed coordinator of Foreign Marketing for Standard Oil Company (N. J.) succeeding to the post long occupied by D. L. Harper who recently retired. Mr. Soubry has served for the past several years as chairman of Anglo American Oil Company Ltd. and prior to the war was in charge of Standard's European marketing.

B. I. GRAVES, vice president of Tide Water Associated Oil Company, has announced the appointment of Herbert S. Chase as manager of manufacturing of the company's Eastern Division, with headquarters in New York. Mr. Chase, a graduate of Harvard, has been with Tide Water Associated since 1922. He has specialized in the field of refining and prior to his new appointment was general superintendent of the company's refinery at Bayonne, New Jersey.

Mr. Graves also announced the appointment of George C. Caine as superintendent of the Bayonne refinery, succeeding Mr. Chase. A graduate of Massachusetts Institute of Technology, Mr. Caine joined Tide Water Associated's refinery staff in 1926 as a member of the Research and Development Department. Since 1938 he has occupied the position of assistant general superintendent at Bayonne.

M. T. HALBOUTY, well known as a consulting geologist and petroleum engineer with offices in Houston prior to the war, was promoted to the rank of Major, U.S.A. on February 1. Major Halbouty has been assigned to duty as an instructor at the Army's Infantry School at Fort Benning, Ga. From the time of his graduation from Texas A. & M. in 1930 Mr. Halbouty was a reserve officer and he was called to active duty as a Captain on February 12, 1941.

HARRY G. SEIDEL, European representative of Standard Oil Company (N. J.), coordinator of marketing outside the United States and Canada, was lost in the crash of the Yankee Clipper at Lisbon, Portugal, on February 22nd. He was fifty-two years old.

Mr. Seidel, a native of Fitchburg, Mass., and a graduate of Brown University, had been with the company for thirty-three years. He had made numerous flights across the Atlantic and was returning to his post in London when the ill-fated Clipper plunged into the Tagus River.

In the first World War he remained in Bucharest during the German occupation of Roumania, the only American to stay in that city. Later he was captured by the Germans. He returned to the United States after the war but in 1919 went back to Rumania where he became managing director of Romano-Americana. Subsequently he headed the Standard-Nobel in Poland. Mr. Seidel came through the bombings of London in the present war without a scratch, although enemy planes scored hits on both his home and office. He is survived by his wife, Mrs. Rosamond Seidel, a son, Harry G. Seidel, Jr., a U. S. Army air cadet, and by two daughters, Rosamond, an ambulance driver for the A.W.V.S. in New York City, and Frances.

HERBERT R. GALLAGHER, a director of the American Petroleum Institute, former president of Consolidated Oil Company and from 1911 to 1932 vice president of Shell Oil Company of California, has accepted an appointment as director of the Office of Petroleum Administration for District Number Five with headquarters in Los Angeles.

Samuel Pratt

SAMUEL F. PRATT, who was elected general secretary of the Pennsylvania Grade Crude Oil Association, Oil City, recently is a native of the oil region, having been born in Titusville. He was educated in the Oil City high school and later attended Carnegie Institute of Technology in Pittsburgh. He first entered the employ of the Association ten years ago as a representative in the field service division in St. Louis. Later he was transferred to Philadelphia and then came to Oil City as supervisor of the field staff. In 1936 he went abroad as European Manager. He returned to this country in 1939 just before the outbreak of the war, assuming the post of assistant manager in the Association organization.

Officers, 1943, New York Chapter of Nomads:

F. J. Olson, President *F. L. Convers, Vice President* *C. J. DeLay, Secretary* *E. M. Gretzler, Treasurer*

CAPT. JAMES F. HARRELL, commander of a Gulf Oil Corporation tanker was guest of honor at a luncheon given in New York on February 10 in recognition of the rescue under his direction of 106 survivors of a Dutch ship torpedoed off the coast of Brazil in November last. P. Van den Toorn, representing the Dutch steamship company presented a fine watch to Captain Harrell and J. J. Ch. de Lange, on behalf of the survivors, gave him a scroll and a cigarette case. Col. J. Frank Drake, president of Gulf, and Willard F. Jones, general manager of the company's Marine Department, were in attendance at the luncheon and are shown with Captain Harrell in the accompanying illustration.

CHARLES W. BOHMER, JR., who has just been appointed assistant supervisor of the fuels and lubricants section of Standard of New Jersey is a graduate of the University of Pennsylvania. He worked as a chemical engineer at the Standard Oil Development Company and was transferred to the Field Service Division in 1933. When this division was transferred to the Standard Oil Company of New Jersey he came with it as a lubrication engineer.

HOWARD F. STOVER, secretary-treasurer of the Gaso Pump & Burner Manufacturing Company of Tulsa, has been elected a director of the National Association of Manufacturers, representing Oklahoma on the Association's Board.

PAUL R. BECK has been elected president of Pennsylvania Refining Company, Butler, Pa., it was announced recently. Also newly elected is John Beck, Jr., as Secretary and Treasurer. Walter W. Beck, M. H. Hindman and Dale T. Glenn continue as vice presidents, Mr. Glenn being in charge of the Ohio Division.

CHARLES RAYMOND BARTON, until recently vice-president in charge of manufacturing for the Eastern Division of Tide Water Associated Oil Company, died on Wednesday, February 17, at his home in Summit, N. J., at the age of 51. Mr. Barton had been with Tide Water Associated for 22 years. He was graduated from Stevens Institute of Technology in 1912.

As assistant chief engineer of the Mexican Eagle Oil Company he was in Tampico, Mexico, in 1914 when an uprising occurred and Mr. Barton was evacuated to Galveston on a United States gunboat. He was made assistant chief engineer and then chief engineer of the Edgewater Steel Company, at Oakmont, Pa.

Sir Frederick Godber

REPRESENTATIVES of the British government have spent the past few weeks in the United States conferring with official agencies on the subject of oil supply. Members of the mission include Geoffrey Lloyd, M.P., chairman of the British Oil Control Board, F. C. Starling, director of petroleum supplies and Undersecretary for Mines, F. H. Humphries of the Tanker Division, Ministry of War Transport and Sir Frederick Godber, director of Asiatic Petroleum Company and a member of the Oil Control Board.

THE New York office of the Mixing Equipment Company, Inc., is now operating in a new setting with a new face back of one of the freshly polished desk-tops.

Mixing Equipment Co., Inc., shifted its New York office from 377 Broadway to 136 Liberty Street. Glenn J. Moorhead, formerly Pittsburgh representative for the company, has assumed the position of Eastern Divisional Sales Manager, with headquarters at the new location. C. F. Donovan will continue his duties as manager of the Liberty Street address.

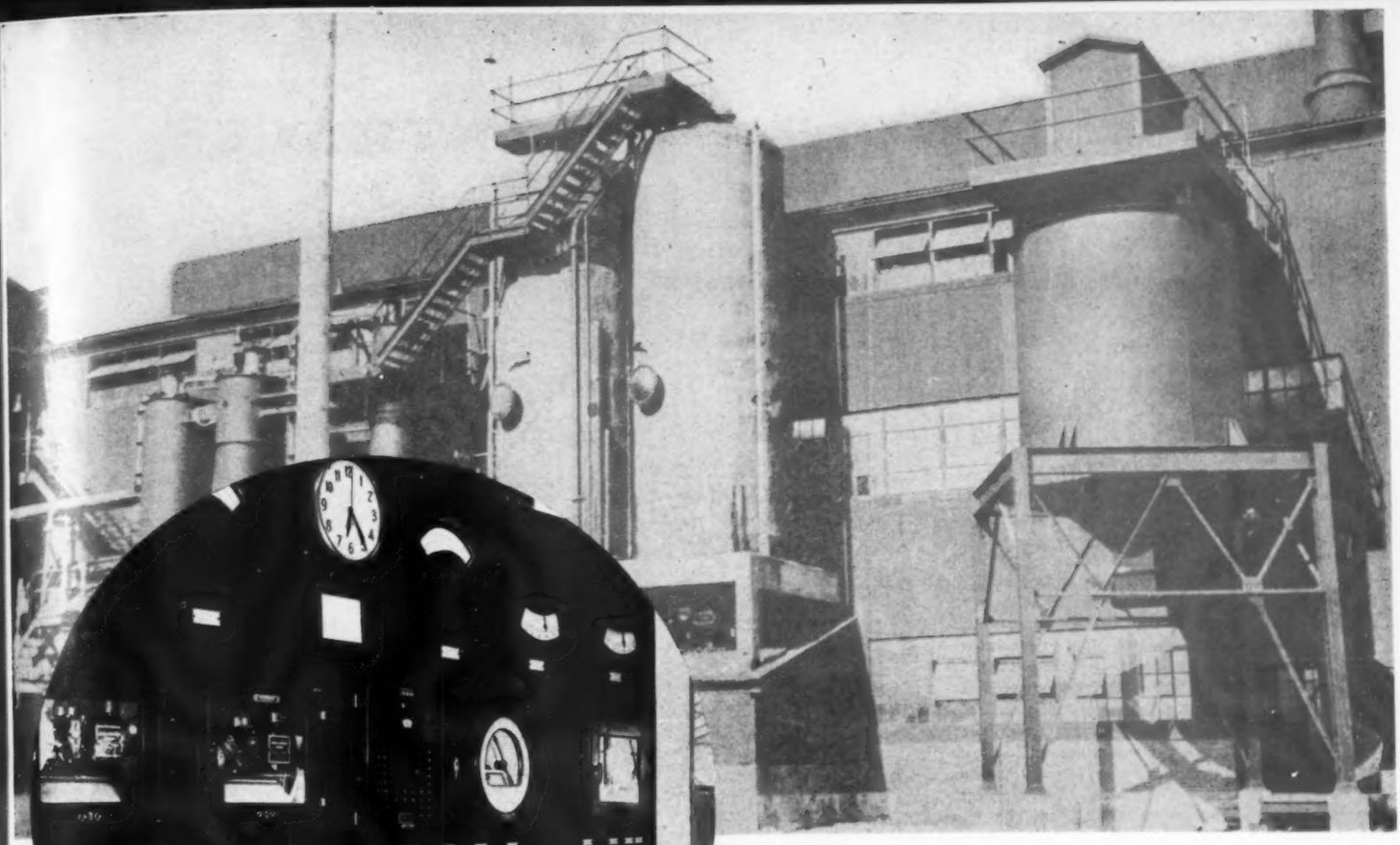
R. P. MAY, formerly with Standard Oil interests in Venezuela and more recently foreign sales representative for the WKM Company with headquarters in Port au Spain, Trinidad has been appointed administrative assistant of petroleum facilities in the Defense Supplies Corporation and will divide his time between Washington, D. C. and field headquarters in Brazil.

WILLIAM P. HEADDEN has been named supervisor of the fuels and lubricants section of the Engineering Division of Esso Marketers. A graduate of Rensselaer Polytechnic Institute in 1929, Mr. Headden entered the employ of Standard Oil Company of New Jersey as a student engineer at the Bayway refinery. He was later assigned to research, primarily in the automotive field, as well as to editorial work on technical publications.

In 1934 he moved to 26 Broadway with the Engineering Division and in 1937 was promoted to assistant supervisor of the fuels and lubricants section.

BURMA OIL CONCESSIONS

IN A LETTER received from Mr. Robert Watson, managing director of Burmah Oil Company, Ltd., attention is directed to statement contained in an article "Control of Oil Resources in Relation to War" published in WORLD PETROLEUM of February 1942. Mr. Watson points out that a passage in this article conveys an inaccurate impression regarding the position of his company in Burma and he makes the following comment: "My company never has enjoyed a privileged and exclusive position in respect of the petroleum resources of Burma. And neither it nor any other company has ever had a lease in respect of them of longer duration that thirty years without a break and renewal. A generation or more ago, 'to give verisimilitude to an otherwise bald and unconvincing' narrative, the exclusive concession of my company was alleged to have been signed by Queen Victoria, and by the present chairman of my company who at its alleged date was not so very far removed from being a babe in arms."



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WORLD PETROLEUM ABSTRACTS

Summaries of the Most Important Articles as Published in the Oil Press of the World Dealing with Technical and Economic Aspects of the Petroleum Industry — Edited by Dr. O. W. Willcox.

DRILLING

The Spontaneous Potential (S.P.) Dipmeter—H. G. Doll, in PETROLEUM TECHNOLOGY, January 1943, Technological Publication 1547; 10 pages.

For some very obvious practical reasons it is highly desirable to know the angle and the direction of the dip of the strata that have been penetrated by the drill hole of an oil well. At the present time this information is obtained by magnetic measurements of selected and carefully prepared cores. Or it may be obtained by noting the position of a certain stratum in at least three neighboring wells; by making electrical surveys in these wells three points in the plane of the stratum will be obtained, from which the direction (strike) and dip of the stratum may be ascertained. But the necessary three wells may not be at hand, and the preparation and examination of cores is time-consuming.

The author has described an instrument for obtaining three points in the plane of the stratum in the drill hole itself. The principle is this: at the contact of two different layers of rock (shale and sand, for example) there is a sharp break in the electrical conductivity, which is commonly observed when the well is logged by a Schlumberger electrical survey. For making use of this principle the S.P. Dipmeter is constructed so as to make three Schlumberger electric logs simultaneously. In this case the electrodes are carried on a frame which separates them by angles of 120°. When the instrument passes a formation contact that is horizontal, all three electrodes will register at the same time on the registering instruments at the surface. If the plane of the contact is inclined (dips) the electrodes will pass the contact at different depth intervals; these intervals are registered at the surface and give the data for computing the dip.

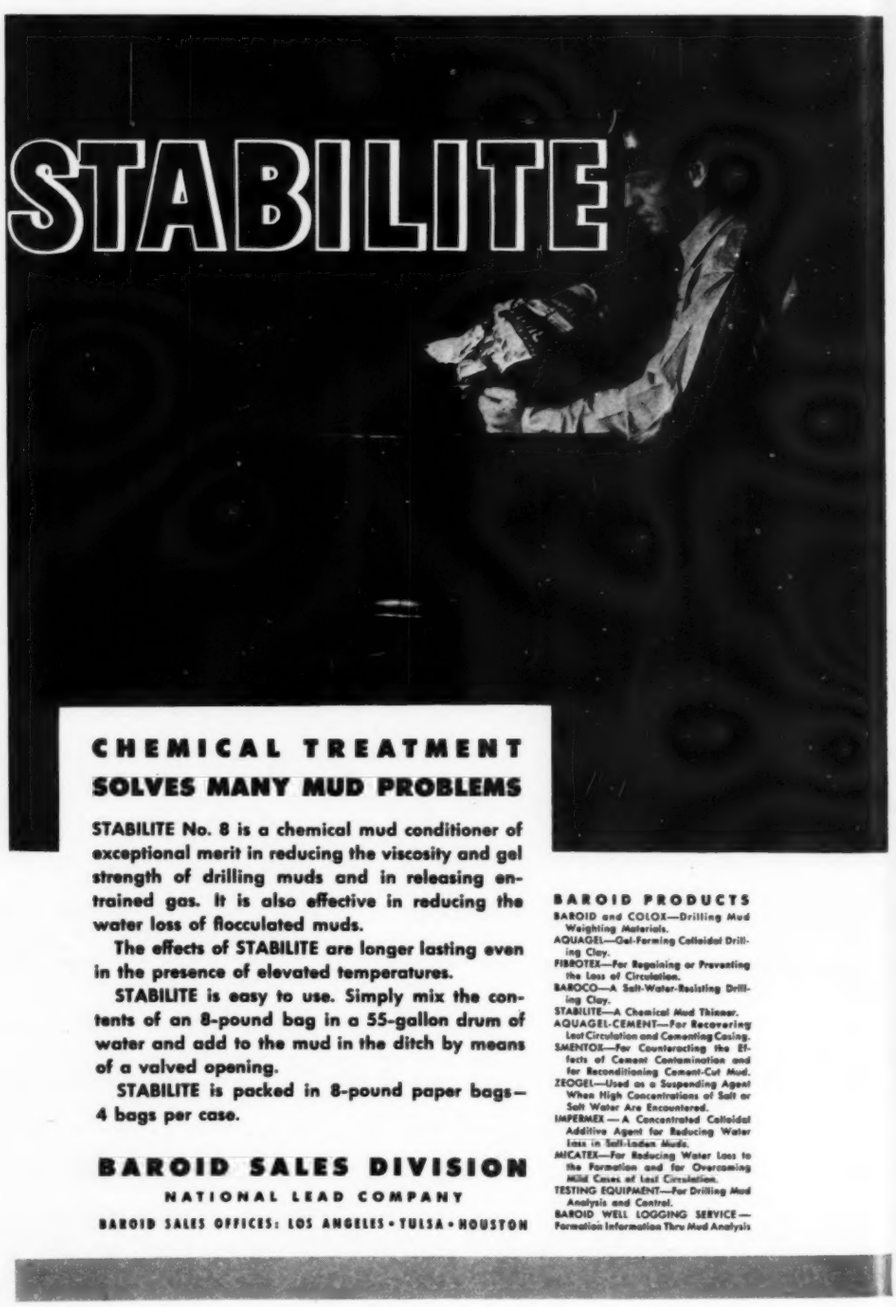
This apparatus offers some possibilities heretofore practically unattainable. Dip determinations can be made at any level in the open hole after it has been drilled, whether or not cores are available. The S.P. survey can be performed at the same time the electrical log is taken, so that both the resistivity and the S.P. measurements are available. This is a time-saving convenience. It also shows the true thickness of the producing horizon or horizons, because it allows making a correction for dip; this becomes of great importance where steep dips occur, as in the neighborhood of piercement type salt domes. In a new prospect where the first hole is dry it is important to determine in which direction to sidetrack or to drill the next well. That question is also answered by the dipmeter, which helps to select the side-track angle. If the first well is a producer the dipmeter measurements will show something about where to set the next location, and in what directions the future field is likely to develop.

Another promising application is the identification of fault blocks. The steeper the dip the greater the precision with which all questions may be answered, but even when the dip is quite small, even scanty information may be of great value in wildcat territory.

Kansas Drawdown Productivity Tests—Neil Williams in OIL & GAS JOURNAL, Vol. 41 (1943), No. 35, pp. 119-120.

Introduced several years ago with considerable apprehension as to its merits, the "drawdown" method of determining well productivity (potential) has been adopted almost universally by Kansas operators. Its application has been responsible for or has made possible changes in drilling, well completion and production procedures that have resulted in greatly reduced requirements for equipment and materials, substantial operating economies, and accruing benefits to producing reservoirs.

The drawdown method supplants the physical tests which are based on capacity output over a specified period of time. These may still be used in Kansas if preferred by the majority of operators in a field, and under certain circumstances may be



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The effects of STABILITE are longer lasting even in the presence of elevated temperatures.

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required by the regulatory officials but now are seldom resorted to.

With the drawdown method, the productivity of a well is computed from measurements of the effects of production upon the height of the fluid column in the well. Production at low rates serves equally well as, if not better than, production at high rates in this calculation. In gas-free or pumping wells, characteristic of Kansas, the fluid column standing in the well is the only force within the well retarding movement of oil into the well bore; hence, reduction in height of the fluid column is a function of rate of production and directly proportional to it, if the resulting values of equilibrium fluid height are plotted against their corresponding rates of production, a "drawdown" curve is obtained, which, extrapolated to zero fluid height, yields the theoretical maximum rate of production.

The advantages to the operator are considerable. There is no need to equip the well to handle more than the regular allowable, hence use may be made of smaller pumping units, with corresponding reduction of other equipment, and general economy in operation. An important saving is smaller casing, and there is even an incentive to save by drilling slim-hole wells. When planning to drill a new well in view of existing restrictions, a saving of more than $12,000 in completion costs may be made. One of the major savings is that derricks may be removed from pumping wells upon completion, and use made of portable units for pulling and cleaning jobs.

Technique of Testing Large Cores of Oil Sands—F. B. Plummer and P. F. Tapp, in BULLETIN AMERICAN SOCIETY PETROLEUM GEOLOGISTS, Vol. 27 (1943), No. 1, pp. 64-84 (8 figs.).

This paper outlines the advantages of large cores in preference to the smaller ones generally dealt with.

The testing of oil sand for estimating oil reserves and determining productivity of oil wells is a major item in petroleum engineering work. Methods have been described and discussed by many writers. Most engineers use only small chunks of the oil sand; generally they recommend cubes or cylinders about 2½ centimeters in size. If all oil sands were of uniform texture, porosity, and permeability, results obtained from a small cube would be representative of the sand as a whole. Most oil formations, however, especially those obtained from limestone reservoirs, are very irregular in porosity and permeability, varying all the way from 6 to 25 per cent in porosity and zero to 3 darcys or more in permeability even where the samples are obtained only a few feet apart. Accordingly, in order to obtain the average permeability or porosity of a reservoir, large numbers of samples need to be tested. If, on the other hand, a core sample that is 3 inches in length and 2½ inches in diameter is employed, then fewer tests are needed. In fact, on the basis of volume, 4 tests of these large cores are roughly equivalent to 61 tests of the small cubes. Thus, much time and tedious work may be saved, if the large cores can be handled properly. It is easier to prepare and easier to manipulate a large core since slices of cores obtained from the well after cleaning can be used directly with minimum preparation. On the other hand, large cores are somewhat more difficult to extract thoroughly, require more solvent, more expensive equipment, and somewhat different technique from the small fragments.

The authors describe equipment and technique suitable for use with the larger cores they recommend, and tabulate some results obtained in their experiments. Small cores, especially limestone cores, are subject to larger overall errors if the permeability is irregular; there is a large chance that the small core will not as fully represent the pore characteristics of the formation as the bigger ones.

Performance of Unconsolidated Sand Wells Using Gravel Packing—Read Winterburn in OIL WEEKLY, Vol. 108 (1943), pp. 20-22; 24, 26.

Some three years ago sand conditions in the Wilmington field (Calif.) led to considerable use of gravel packed liners. Experience with this practice, with special reference to gravel-packed liners and prepacked liners from the standpoint of production, is here reviewed. This experience is condensed in the following summary:

Reduction of production expense, ability to produce at higher rates for several years, and elimination of the risk of sand abrasion and collapse of liners can be attained through the use of circulated gravel packs and prepacked liners in areas and zones presenting acute sand problems.

Where all sand is screened by the gravel pack, plugging at the gravel face may reduce the productivity of the well to uneconomic rates before the producing sands are depleted.

There is possibility of increasing the economic life of wells without necessity of remedial work by use of gravel large enough to permit production of small amounts of sand continuously. However, this practice entails increased operating costs and greater risk of eventual damage to liners.

Possibility of using smaller water strings and still providing ample clearance for washing over and recovery of liners with the same inside diameter

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in the case of the circulated gravel packs should be considered. This is illustrated by the fact that a 4-inch liner may be washed over through a 7-inch water string while the same liner prepacked to 5½-inch outside diameter would require an 8⅝-inch water string to permit washing over.

In deciding whether to select gravel designed to screen all sand or to permit small quantities of sand to be produced with the oil, no general rule can be stated. All experience bearing on the particular case under consideration should be reviewed. Those wells in which initial production rates of from 100 to several hundred barrels per day are anticipated and which experience has shown may be expected to have relatively long productive life before declining to uneconomic rates are in a position to benefit to the greatest extent from the minimum production costs and absence of risk of damage of the liner to be gained by complete exclusion of sand. On the other hand, low-pressure-heavy-oil zones yielding wells of small initial production afford the best opportunity for advantages to be gained from use of coarse gravel to permit some sand entry into the well.

Effects of Certain Gums and Starches on Filtration of Salt Water Muds at Elevated Temperatures—Frank Perkins and Benjamin C. Craft, in PETROLEUM TECHNOLOGY, January, 1943, Technical Publication 1551; 4 pages.

One of the main concerns of the "mud engineer" on a drilling job is to control filtration, or the loss of water from the mud to the formation. One of the outstanding factors that cause excessive filtration is the presence of electrolytes in general and salt in particular, which neutralize the negative charge on the clay particles and cause them to flocculate. This action of salt is aggravated by high temperatures such as prevail at wells on the Gulf Coast.

The work under review was undertaken to study certain materials available for controlling the filtration characteristics of salt water muds at high temperatures.

Laboratory tests indicate that gelatinized starch, commercially prepared starch, and gum ghatti are very effective reducers of filtration loss at high temperatures. Gum ghatti, while rather difficult to disperse, is the most stable and effective. Commercially prepared starch is recommended for general field use because it is not adversely affected by temperature and is readily available at a reasonable cost, whereas the gums are not available in large quantities in the present world situation. A germicide should be used with all treatments, to prevent fermentation, with the possible exception of the gelatinized starch in highly alkaline muds. Pentachlorophenol and the sodium salt of trichlorophenol are suitable germicides.

It is pointed out that no existing laboratory method will permit an approximate determination of filtration rate at high temperatures from data taken at room temperature. Therefore, in experiments of this kind, filtration rates should be measured at the temperature which is expected in the well, or at least at a number of lower temperatures, the relation being then extropolated over a small range.

PIPELINES

Effect of the Kinetic Energy Term in Gas Flow Calculations—Benjamin Miller, in CHEMICAL METALLURGICAL ENGINEERING, Vol. 50 (1943), No. 1, pp. 90-91.

As gas flows through a pipe its pressure decreases, and its specific volume correspondingly increases. Since the cross section of the pipe remains constant, the velocity of the gas must increase; so also must its kinetic energy. This increase in kinetic energy as well as the surface friction must be supplied by the decrease in pressure.

Usually the surface friction is so large compared to the increase in kinetic energy that the latter may be neglected. But when the flow rate is high and the initial pressure low the increase in kinetic energy may be important. It is therefore of importance to have a means of calculating gas flow under given conditions. This paper presents a simplified calculating process which is an improvement over the previous method in that it gives a closer representation of kinetic energy increase and outlet pressure.

The usefulness of such calculations is that while the efficiency of a pipe line cannot exceed 100 percent, if it is in good condition the efficiency should be 95 percent. A calculated efficiency under 90 percent is an indication that something is wrong with the line.

PHYSICS

An Electrical Device for Analyzing Oil Reservoir Behavior—W. A. Bruce in PETROLEUM TECHNOL-

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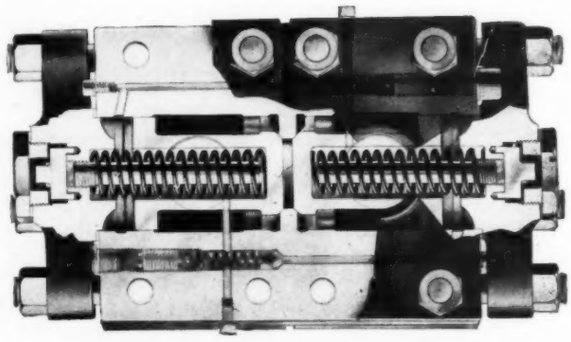

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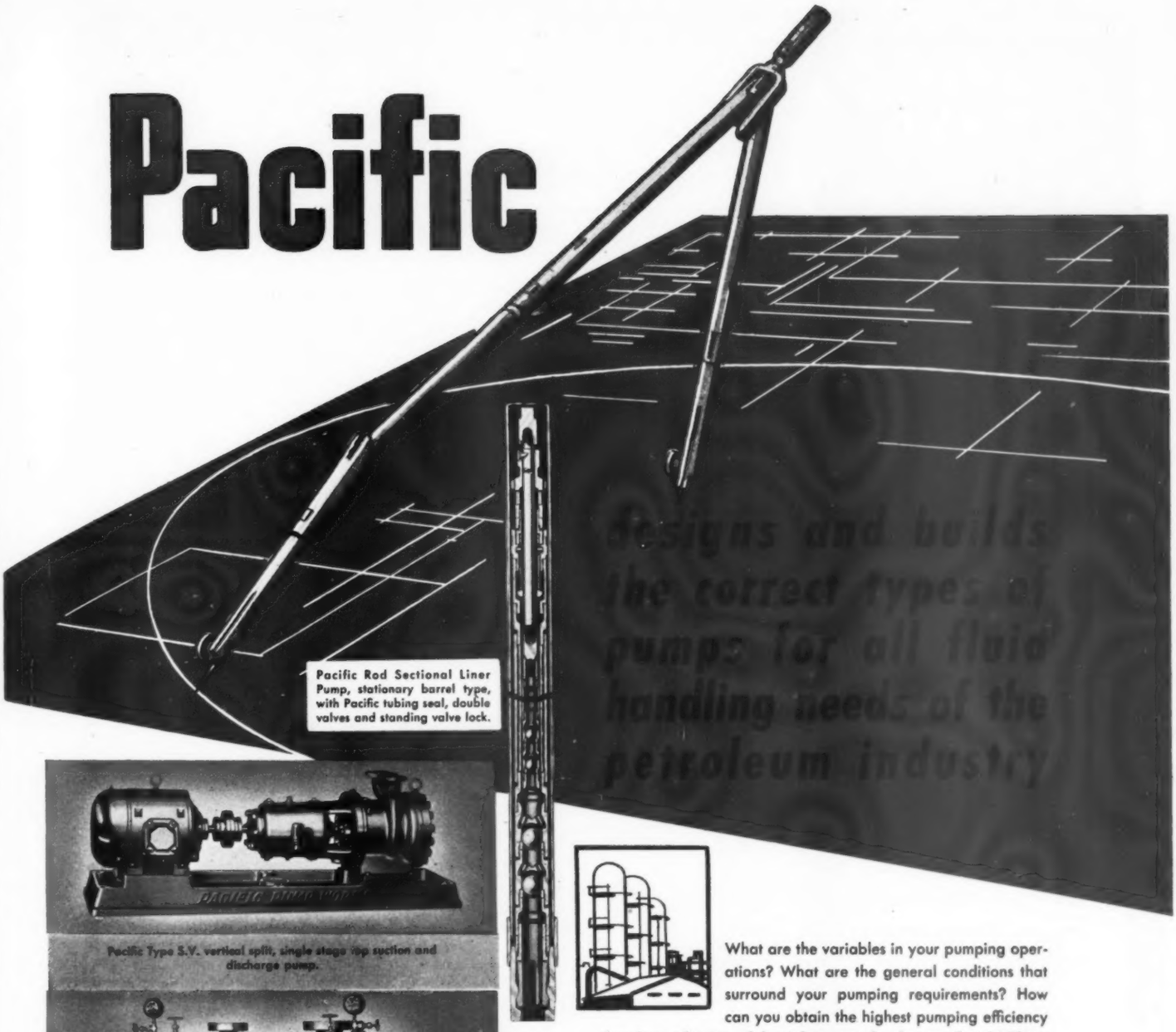

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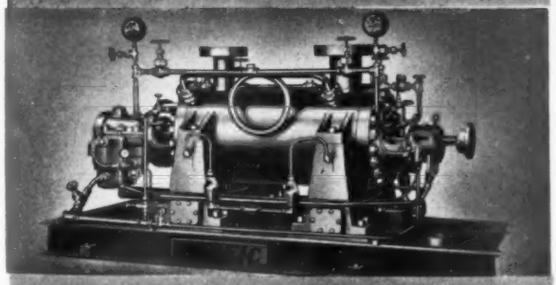

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ogy, January, 1943, Technical Publication 1530; 13 pages.

When an oil pool has been discovered and is in process of development the operators would like to have some idea of how the reservoir may perform in the months or years to come. The mathematical physicists who have turned their attention to the physical data of oil sands have worked out mathematical formulas for solving such problems, and for simple cases these formulas are not too difficult to apply, but there are other cases which have been thought too difficult for practical solution by mathematical means.

The author has invented a method for the mechanical, or rather electrical solution of these problems. The apparatus used consists of a series of electrodes, resistors, capacitors, etc. Electric energy flows in at one end of the system and out at the other end; the amount of electric energy that flows out will depend on obstructions that may be introduced into the system.

It has been found that such an electrical system can be constructed to represent various physical phenomena that conform to mathematically expressed laws. For example, the idea has been employed in other industries to solve problems of steady and unsteady heat flow problems, and the same general principles have been applied to the study of impact problems. For its practical application to oil pool problems the present author constructs an electrical model which basically represents the physical constants of the reservoir, such as bbl. per day, formation thickness, permeability, viscosity, volume, etc.

These values are represented by electrical units that behave in respect to the flow of electricity exactly as the reservoir units behave under various conditions of fluid flow. The electrical units are then wired together in the same way that the reservoir units are connected naturally by virtue of their geometrical locations and shapes in the field.

The operator of such a model then makes adjustments of the resistors to represent pressure, permeability, viscosity, and puts the monthly production figures through the machine (as it were); the resistors are adjusted until ammeters show the proper average daily production. Once the resistors have been set to correspond to the past history of the pool no further changes are needed to project the synthesis into the next 2½ years of development.

How it works in practice is illustrated by taking the Dix Pool, in the Bethel sand of Jefferson County, Illinois, as an example.

REFINING

Storage and Containers for 1-3-Butadiene—Anon. CHEMICAL METALLURGICAL CHEMISTRY, Vol. 49 (1942), No. 11, p. 117.

The Mellon Institute of Industrial Research has issued its Bulletin 7381-B reporting some research on the storage of 1-3-butadiene.

Results of this research indicate that 1-3-butadiene should be stored at a temperature of about 32° F., at which it has a vapor pressure of approximately 3 lb. per sq. in. gage. This conclusion is supported by the following reasons:

(1) The loss of product at 32° F. through d... merization and polymerization is practically negligible, such loss being less than 1/40th of that oc... curring during storage in the usual steel containe... during the warm summer months.

(2) Storage at about 32° F. results in the lowe... initial cost of the storage plant and also the low... est total annual operating cost.

(3) The amount of steel required for containe... at the recommended storage temperature of 32° F... is less than ½ of the amount required for contain... ers in which 1-3-butadiene is stored at ambie... temperatures.

(4) The containers should be of maximum siz... for the total capacity involved, because within the... range of capacities considered for rubber plant... and the producers of synthetic rubber raw ma... terials, the larger the container size, the lower the... cost per unit of product stored.

The Bulletin contains specifications for variou... types of containers, and data on pressures and tem... perature conditions of storage.

USES

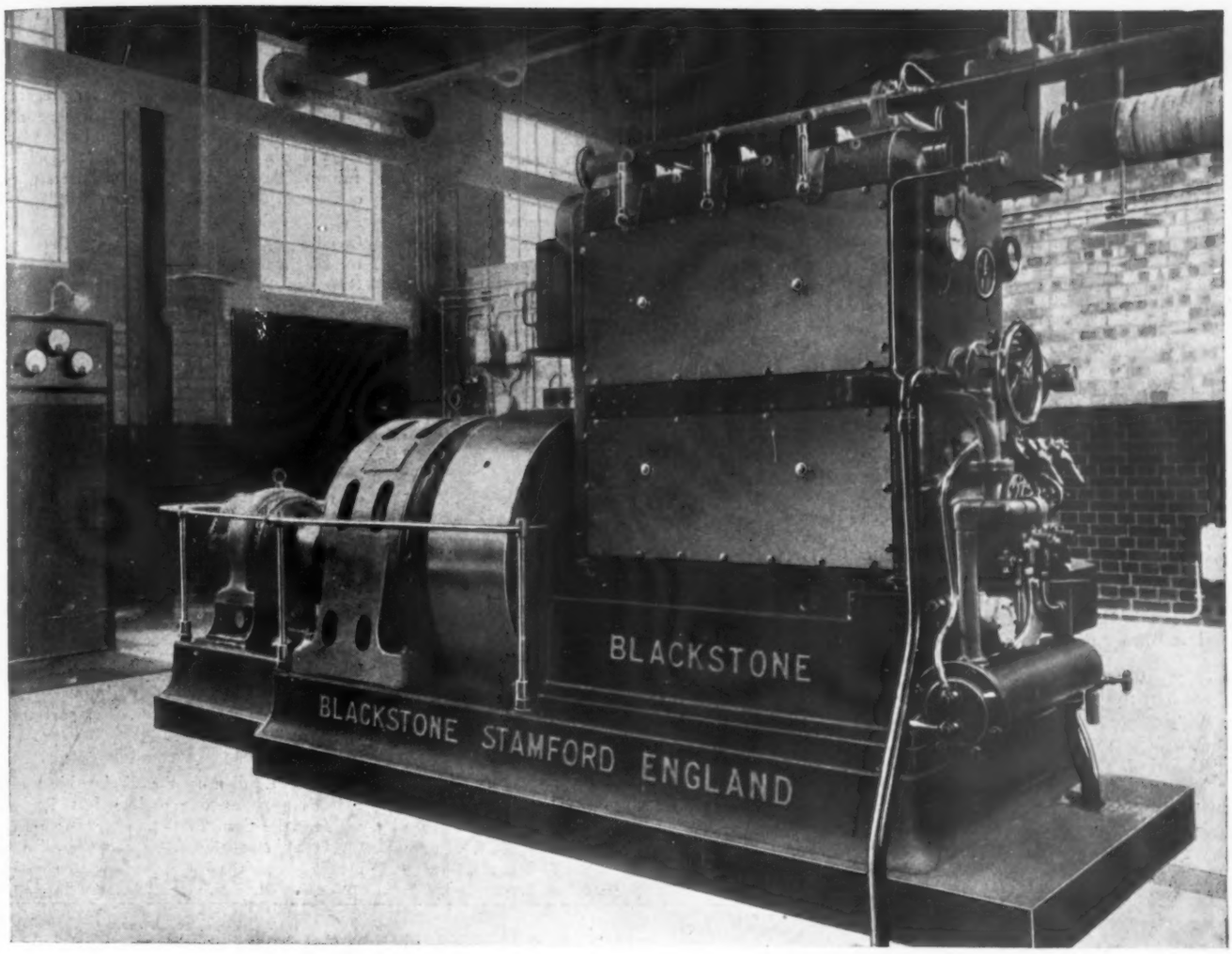
New Testing Methods for Lubricating Greases—H. Weichelscheid, in OEL AND KOHL, Vol. 3... (1941), No. 13, pp. 236-240.

In this report the director of research on bearing... for the German railway administration describe... some interesting tests for revealing the properti... displayed by greases in practical use. Emphasis i... laid on the reproducibility of these tests.

The consistence test is carried out as follows: Th... grease to be tested is placed in a container F... the bottom of which functions as a perforate... plate. The container F is placed upon the vesse... A and is covered with the hood C; all joints ar... ground to air tightness. F and C are connected t... a vacuum line with a two-way valve at P and... stopcock at D. After placing the grease in F th... entire apparatus is evacuated of air with D open... Then D is closed and air is admitted into C... The vacuum (100 mm of mercury) in A tends t... suck the grease through the perforated plate and... the mercury in the manometer falls in proportio... to the amount of grease that passes through, whic... again depends on the relative softness of the grease... The time rate of the fall of the mercury is re... corded by photographing the manometer at interval... and constructing a curve. Different temperature... may be used. Before the test is made the grease... should be vigorously mixed. According to the au... thor, the tests are "unconditionally reproducible."

Another test is designed to measure the tendenc... to separate oil on warming up. For this test us... is made of an aluminum vessel 73 millimeters wid... and 80 mm tall; it has a bottom containing 27... holes 2 millimeters in diameter; 350 grams of th... grease are placed in this vessel, which in turn i... hung in a sufficiently large glass vessel. The whol... is then maintained at a temperature of 80° C. fo... 50 hours, whereupon the oil that has passed throug... the holes is collected and weighed. The amount o... oil thus separated should not exceed 2 percent (... grams). The test figures on four very differen... greases show excellent reproductibility.

The author describes a "gel test" for railway bear... ing greases, the necessity for which arises out of th... following circumstances: When a grease box i...



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opened after a run there may be seen a gummy cake; no oil adheres to the metal, so the bearing is dry. This is due to the fact that the solubility of the soap in the oil is not complete except at high operating temperatures, when a gel of oil and soap is formed; at lower temperatures a part of the soap again separates and the gel character disappears. For determining this gelling property the following test is used. A sample of the grease is packed into an 80 x 73 mm cylinder provided with a perforated screen bottom, vessel and grease are placed on a tripod and kept at 80° C. for 24 hours to separate a portion of the free oil. Thereafter the wad of grease is removed and enclosed between the halves of a split cylinder (see sketch) which are hinged together on one edge and loose on the other. After putting the wad of grease in position the upper half of the split cylinder is pressed down so as to lower the pointer on the upper half a distance of 5 millimeters. Pressure is removed and the position then taken by the pointer is regarded as zero; the pointer is now depressed 10 mm more; any rebound is taken as a measure of gel formation.

Experience shows that a good grease will not form a gel and hence the pointer does not rise.

Emergency Use of Oil-Coal Suspensions as Colloidal Fuel—W. L. Faith and H. W. Zabel, in REFINER, Vol. 22 (1943), No. 1, pp. 69-71.

The critical fuel-oil shortage occasioned by transportation difficulties has made a decrease in oil consumption imperative. In most cases this involves scrapping of oil-burning equipment and converting the furnaces to coal burners, but this is more or less impracticable under the existing circumstances. An alternative is the use of colloidal fuel (suspensions of coal in oil). It is possible to prepare such suspensions containing as high as 50 percent coal by weight and still retain many of the advantageous characteristics of fuel oil. In addition there are also the certain advantages of economy of use of present storage and handling facilities, and even more important, transportation economy. On top of this, we may have the added advantages of colloidal fuel over all other fuels. The two most noteworthy advantages in the present emergency would be the higher calorific value per unit volume, and the efficient use of local low-grade solid fuels.

The essential steps in manufacturing colloidal fuel are (1) grinding and sizing the coal, and (2) mixing it intimately with the oil. It is possible that the two steps could be combined by grinding the coal in an oil medium, but since data on such a process are lacking, the two-step process is recommended for present use. The exact degree of comminution is an economic problem which remains unsolved. Hedrick suggests 90 percent through 200 mesh as an optimum coal fineness, but states that 75 percent through 200 mesh would be satisfactory. Manning and Taylor agree with this latter statement. In either case this degree of fineness could easily be obtained in ball mills, hammer mills, or ring-roll mills, of the types used in pulverized coal practice.

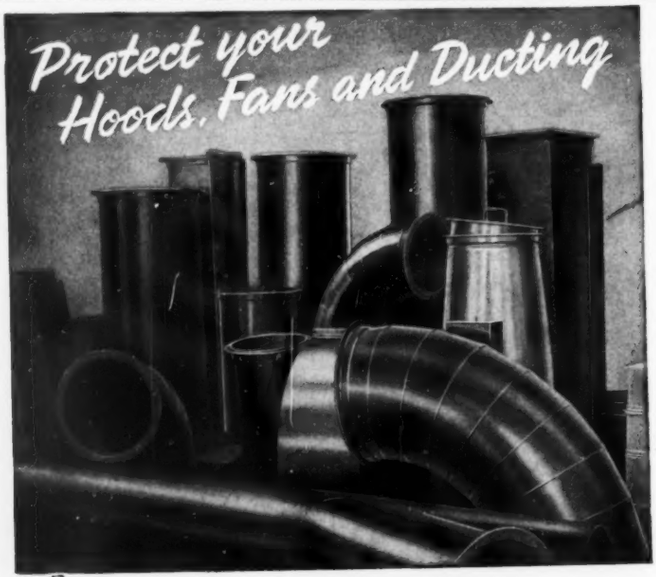
However, although it is possible to obtain an atomizable mixture of coal and oil and to make the mixture of low viscosity and flowable by the use of steam coils, the problem of keeping the coal in suspension remains to be fully solved by finding a cheap and widely available surface-active substance that will function as a stabilizer. A definite choice of such a stabilizer has not yet been made, but the authors state that it is possible to prepare a stable fuel without a stabilizer by proper preparation and handling of the fuel, by which they mean fine grinding, thorough mixing, agitation and pumping. They cite a number of facts that should be carefully weighed by combustion engineers who may be confronted by the fuel problem.

Consistency Test for Lubricating Greases. Counter-Balance Modification for Soft or Liquid Greases—Harry Levin and Charles J. Schlagel before Division of Petroleum Chemistry, AMERICAN CHEMICAL SOCIETY, St. Louis meeting, April, 1941.

A simple modification of the ASTM method for determining consistency of lubricating greases is described which extends the utility of the ASTM apparatus and method to very soft and liquid greases. Although it does not interfere with regular ASTM penetrations the apparatus modification is one that can be installed or removed in a few minutes by simply disconnecting a thread. In essence, the modification consists in counterbalancing the moving weight of the ASTM apparatus (150 grams) to any desired lesser weight. The use of such lesser weights brings the penetration of very soft greases within the scale of the standard apparatus.

Increased Fuel Economy Through Operation on a Reduced Number of Cylinders—A. Ludlow Clayden and J. G. Moxey, in report to Sun Oil Company, August, 1942.

As a contribution to the vital subject of making reduced supplies of gasoline last longer or go farther, the Sun Oil Company has released this report of its engineers on the operation of automobile engines with only half the cylinders in action. Exhaustive road tests with 4, 6, and 8



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cylindered engines of various makes showed that the fuel economy at 20 miles per hour was as much as 51 per cent in some cases, and appreciable in practically all cases, even at higher speeds. Information on how to make the necessary changes in the engine is given.

BOOKS

Standard Methods for Testing Petroleum and Its Products—(Fourth Edition, 1942). Published by The Institute of Petroleum, London (England). 400 pages, 97 diagrams. 15s. 0d. ($3.00)

The new edition of "Standard Methods for Testing Petroleum and Its Products" represents a thorough revision of the majority of the methods described in the Third Edition and all those which have been published in the "Journal of the Institute of Petroleum" since 1935.

All methods have been re-written, incorporating improvements developed since the last publication. Special attention has been given to the adoption of the International Standard definitions of accuracy, precision and tolerance.

An attempt has been made to include all test methods which are required in official specifications, and particularly those of the British Armed Services. For example, the oxidation test required for aircraft lubricating oil according to the (British) Ministry of Aircraft Production specification is now published in detail for the first time.

Among other new methods are: aniline points of products which develop high pressures at the aniline point; diesel fuel diluent in crankcase oils; Abel flash point of viscous petroleum products; specific gravity by displacement, by flotation, and by the Westphal balance; and a rapid method of determining sulphur by combustion in a quartz tube.

The usefulness of the book has been increased by the inclusion of methods of calculating diesel index and viscosity index, tables for the conversion of kinematic viscosity to Redwood viscosity, and also of various methods standardized by the American Society for Testing Materials. These latter tests include color by Saybolt chromometer, Cleveland flash point, gum stability, aviation fuel knock-rating, and the centrifuge method for sediment in fuel oil.

The tests are grouped under the main heads of crude oil, motor fuels and white spirit, kerosene, lubricants, diesel oil, gas oil and fuel oil, asphaltic bitumen, paraffin wax, sampling and measurement. These main groups are further subdivided into sub-groups or panels, each of which represents the collaboration of four to eighteen specialists. The result is a quite comprehensive coverage of the whole range of petroleum testing.

Oil Property Valuation—By Paul Paine. Published 1942 by John Wiley & Sons, New York; 204 pages; $2.75.

Heretofore experts who have written about the valuation of oil properties have been concerned chiefly with the important elements of the oil and gas contents of the subsoil. Less attention has been given to outside influences which affect the value of the oil and the gas; the matter of selecting a valuation method that is appropriate to given circumstances has not, in general, been given sufficient consideration.

In an effort to close this gap the reader's attention is fixed on three main points: (1) the recoverable oil; (2) the profits to be realized by the extraction of this oil, and (3) the resulting values under various conditions. Less emphasis is placed on the matter of estimating the oil and gas reserves, which is more or less strictly the job of the geologists and the field engineers.

The discussion starts with a consideration of what is value, which is a word of many meanings or descriptions, such as real value, true value, exchange value, forced sale value, going concern value, replacement value, income value, fair market value, enterprise value, intrinsic value, the "power to command a price." For the author's purposes the valuation of an oil property is a process of estimating its value at a specific time; it is an appraisal. In the great majority of cases, the fundamental objective is to ascertain that amount of money for which the property will sell in the market. This obviously requires that the appraiser must be sure that a market exists, meaning that buyers are somewhere around. Proof of the existence of the market is to be looked for in the records of contemporary sales of the same kind. As a practical matter valuation means, in the end, fixing a price in view of the known or fairly certain existence of a buyer who will be willing to pay that price. In order to smoke out a potential buyer the appraiser must list all the tangible and intangible features of the proposition. In this sense a valuation is perhaps of much more importance to the buyer than it is to the seller. How well the author has succeeded in providing a useful guide in this intrinsic business may be left to users.

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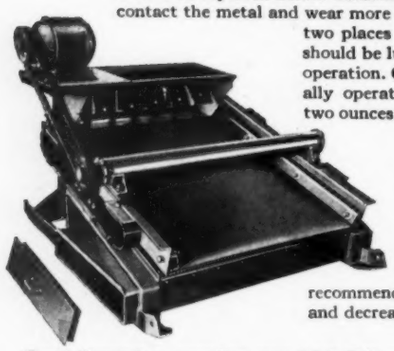

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(Formerly entitled: Petroleum and Its Products)

By W. A. Gruse and D. R. Stevens
Mellon Institute of Industrial Research
725 pages, 6 x 9, $7.50

Thorough and up-to-date, this book completely covers the chemistry of petroleum and the modern methods of petroleum production and utilization. In the most convenient form, it provides detailed descriptions of the important types of petroleum, gives a critical comparison of the various methods of refining and distilling and processes of cracking, and includes a thorough discussion of all petroleum products and by-products.

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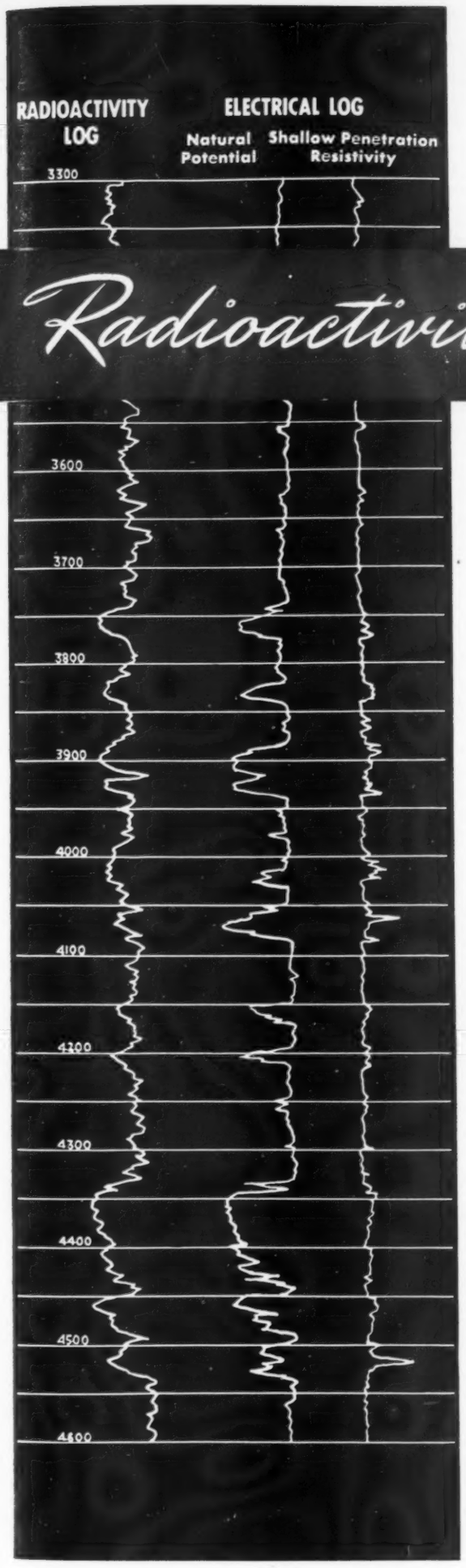

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WHEREVER MEN DRILL FOR OIL

Scientific Systems of Survey

(Continued from page 29)

fact that more dry holes result from all methods is no reflection on geologists and geophysicists but is merely a confirmation of the increasing difficulty in finding new fields as those more accessible naturally are the first to be developed.

In the opinion of competent authorities the present emergency calls for a broader and more intensified employment of geological, geophysical and geochemical surveys and for the use of all the tools that these methods have developed either singly or in combination in recognition of the fact that greater effort than heretofore put forth is needed to maintain a safe level of reserves.

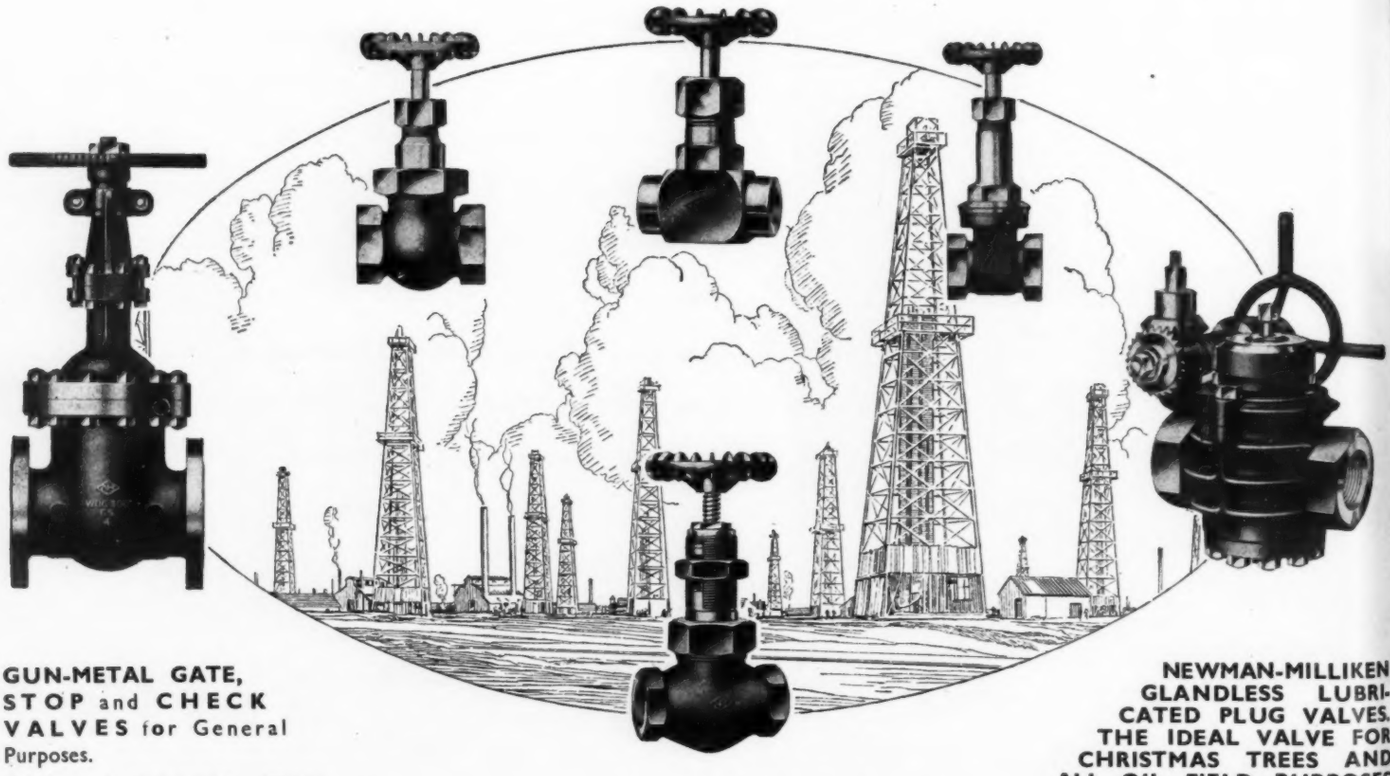
Not only must more new fields be brought in but drilling must be carried to greater depths and extended to areas that are in the marginal or doubtful category. All of this means that discovery is becoming and will continue to become more expensive. In the past the rising cost of exploration has been offset to some degree by the introduction of economies in methods and equipment. Withdrawals of oil for consumption have exceeded discoveries in entirely new locations for the past few years but reserves continued to grow until 1941 through additions to and reappraisals of existing fields. Such extensions will add to known accumulations in the future as there are many partially explored districts surrounding areas of current development where the existence of oil is practically certain though lack of definite proof prevents them from being included in estimates of reserves. In this connection it must be remembered that considerable time is likely to elapse between the survey of a field and demonstration by actual drilling. The smaller additions to reserves during the past year or two reflect the lowered rate of geophysical exploration preceding that time.

One of the arguments in favor of greatly extended survey and drilling activity is the possibility of thereby discovering important deposits located in stratigraphic traps which are more difficult to locate by ordinary methods of survey than are other types of structures. Some of the most productive fields in the country including the largest of all, East Texas, are of this character.

At the present time the oil industry is moving to meet the need for an expansion of the country's oil reserves in two ways. One is by extending the work of geological and geophysical survey to a degree that engages the services of practically all available men with the technical knowledge and experience needed for such work. The other is by conducting a study, district by district and company by company to determine further procedure in this direction with the materials and manpower available and to fix upon the locations in which new drilling should be done in order that its productive results may satisfy immediate war needs.

The lesson to be drawn from the present situation of United States oil reserves is not one of discouragement but one that impresses the need of greater activity and more intensive effort to locate undiscovered deposits. The requisites for such a campaign are the utilization of existing geological and geophysical methods of survey separately or in combination, the perfection of improved methods and instruments, and the drilling of many more exploratory wells. To make this possible the essential requirement is not physical but economic. It involves the establishment of a higher price for oil.

VALVES FOR THE OIL INDUSTRY



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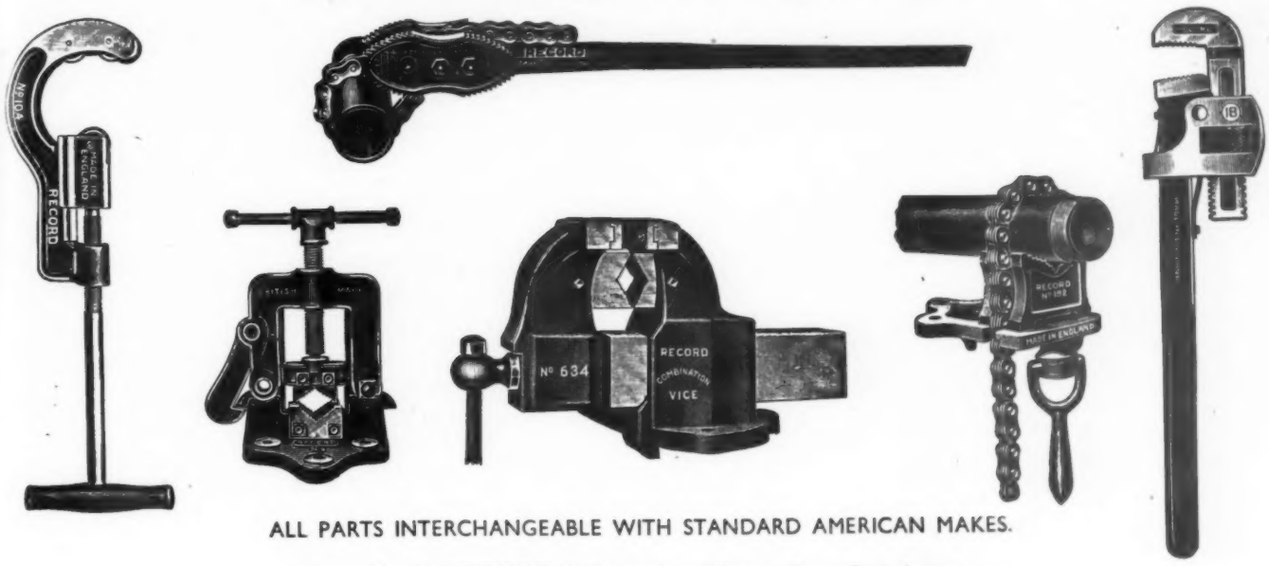

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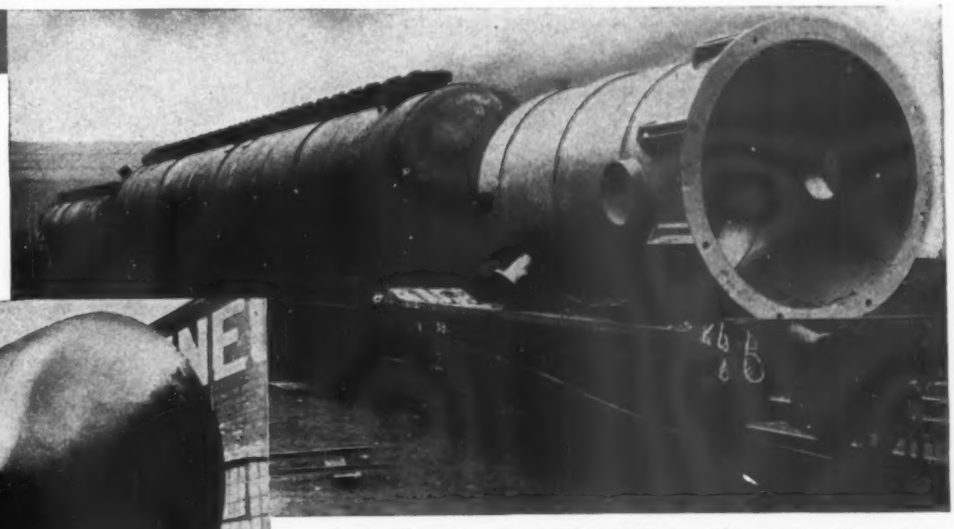

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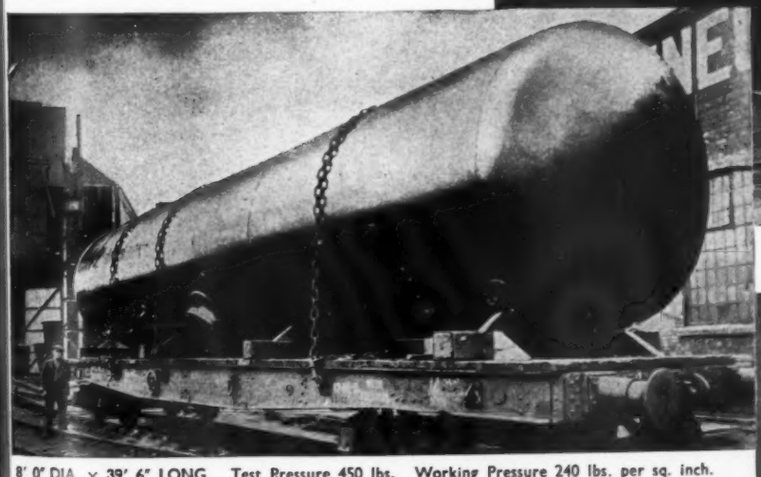

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Estimate of 1942 World Production

IN A REPORT submitted to the Petroleum Division of the American Society of Mining and Metallurgical Engineers on February 18, V. R. Garfias, R. V. Whetsel and J. W. Ristori of the foreign department of Cities Service Company estimated world production of petroleum and substitutes during 1942 at 2,208,000 barrels, a decrease of 171,000,000 bbl. from the estimated output of the preceding year. Crude production is believed to have decreased by about 200,000,000 bbl. or nine percent while substitutes are credited with an increase of 28,500,000 bbl. or more than 20 percent. Outside the United States marked declines occurred in Venezuela and Colombia, due to lack of transportation and in the East Indies and Burma as a result of military invasion.

For several years past the authors have prepared reports of world production and consumption but they point out that under existing conditions data on consumption are unavailable and that no more than a rough estimate of production is possible.

Subject to this qualification their estimate for 1941 and 1942 is as follows:

TABLE I

WORLD PRODUCTION OF CRUDE PETROLEUM AND ITS SUBSTITUTES

(Thousands of Barrels)

Countries	1941 Crude	1941 Petroleum Substitutes	1941 Total	1942 Crude	1942 Petroleum Substitutes	1942 Total
U. S. A.	1,404,180	67,680	1,471,860	1,385,000	79,000	1,4
U. S. S. R.	240,000	1,500	241,500	212,000	2,000	2
Venezuela	223,000	1,200	224,200	145,000	1,500	1
Iran	78,000	1,000	79,000	76,000	1,000	
Netherlands India	62,120	1,000	63,120	9,000	200	
Mexico	41,200	1,000	42,200	35,000	800	3
Rumania	40,500	2,000	42,500	41,000	2,000	43
Germany	5,240	32,000	37,240	5,400	46,000	51
Colombia	24,400	900	25,300	10,600	900	11
Argentina	21,800	500	22,300	22,000	600	22
Trinidad	21,200	200	21,400	24,500	200	24
Peru	12,900	1,000	13,900	13,500	1,000	14
Canada	6,300	3,700	10,000	6,400	3,900	10,300
Iraq	12,500		12,500	14,800		14,800
Japan*	3,300	5,500	8,800	3,400	6,900	10,300
Egypt	7,700	200	7,900	8,000	300	8,300
Burma	7,800	100	7,900	2,400	100	2,500
Bahrein Island	6,900	200	7,100	7,800	200	8,000
United Kingdom		7,000	7,000		7,500	7,500
Sarawak	1,340		1,340	500		500
Brunei	5,460		5,460	1,000		1,000
Saudi Arabia	5,870		5,870	6,000		6,000
France	500	4,100	4,600	500	4,800	5,300
Poland	3,310	200	3,510	3,400	300	3,700
British India	2,270		2,270	2,500		2,500
Hungary	2,600	100	2,700	3,800	200	4,000
Ecuador	1,500	50	1,550	1,800	100	1,900
Italy Albania	1,200	300	1,500	1,500	400	1,900
Miscellaneous	700	4,200	4,900	800	4,300	5,100
	2,243,790	135,630	2,379,420	2,043,600	164,200	2,207,800

* Estimated.

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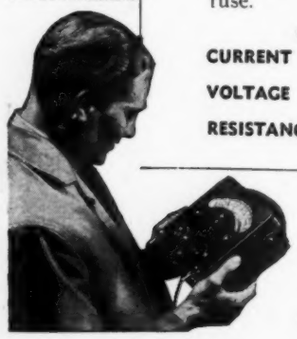

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